Research Paper

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Solid Waste Management Trendsand its Divisional Frames of GHMC Wards of Hyderabad City.

Management

KEYWORDS : Geographical Information System; Municipal wards; Greater Hyderabad Municipal Corporation.

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ABSTRACT

The aim of this study is to find out the sustainability scenario of solid waste management with respect to the rising population in the city of Hyderabad. The use of Geographical Information System (GIS) in classifying the city into sustainability classes based on the grouping of different circles and municipal wards based on the per capita waste generated by each. It is generally found out that a bigger percentage of the municipal wards are low in sustainable waste management. A considerably significant number of the wards were rated 'very good' in sustainable waste management. By this a proper and sustainable waste management can be achieved through proper collection, transportation and disposal of wastes.

1. INTRODUCTION

With the increase in population, urbanization and economic development, there has been a significant increase in municipal solid waste generation in Hyderabad making its management and disposal a problem. Urbanization is a worldwide phenomenon. The process of Urbanization is very rapid. The solid waste generated by the daily activities of the people needs is to be properly managed in such a way that it minimizes the risk to the environment and also human health (Amar M.R 2012). The main problem of urban waste management is worth noting not only due to the large quantities of waste produced and the spatial spread, but also the problems encountered in the setting up of the systems for collection, transportation and disposal of the wastes (Anand.G 2014)

2. OBJECTIVES

- To map the population density and solid waste characteristics of the municipal wards of Hyderabad
- To determine the main sources of waste generators and waste characteristics in Hyderabad
- To determine the sustainability ratings of municipal wards of Hyderabad and the expected future waste generation trends

3. STUDY AREA

The area under study is the city of Hyderabad Urban Agglomeration situated in the state of Telangana. Hyderabad is the capital city of Telangana and is the sixth largest city in India, closely behind Bangalore [6]. The city has been divided into five (5) zones namely North, South, East, West and Central zones with 18 circles and around 150 municipal wards.

4. MATERIALS AND METHODOLOGY

Use of spatial and non-spatial.obtained from SOI, NRSC and GHMC. The circles and ward boundaries are digitised from top sheet and updated from satellite imagery. The attribute data was used based on the size of this study area. The information acquired highlighted the status of waste management in Hyderabad city, discussed under sources and characteristics of the wastes, wastes collected and transported to disposal sites, availability of the number of sanitary workers, predicted future trends in waste production with respect to population density. Based on the per capita solid waste generation data of the wards in the city, GIS analysis was performed and the wards were categorized into different groups to show their sustainability.

(i) Population characteristics of municipal wards of Hyderabad

The city of Hyderabad is ranked the sixth largest urban agglomeration in the entire country. The population growth experienced (4.3 to 5.7 million) during the decade 2001-2011 is further expected to continue to increase by 13.64 million 2021 (Singh, 2010). Courtesy of the Greater Hyderabad Municipal Corporation (GHMC), the city is divided into five zones whose average population densities in persons per square kilometer are: East zone (7899.86), South zone (32777.42), Central (27257.28), West (6684.3) and North (16590.98) zones.

(ii) Solid waste in Hyderabad

Urban areas in the state of Telangana have generated solid waste more than 11.5 thousand tons/day which is a 9% of all solid waste generated in India. Every individual in Telangana generates solid waste on an average 570gm/day which is close to other states, such as, Tamil Nadu (630 g/day) and Jammu and Kashmir (600 g/day). Greater Hyderabad generates about 5,000 tonnes of waste per day (TPD), which accounts for 1.83 million tons per year (Bhambulkar A.V.2011). It is an appalling phenomenon how wastes in Hyderabad, just like in other cities, can be thrown from one's house without considering the long-term effect of the same. Much as there are waste containers provided by the GHMC, dumping wastes anyhow is not a concern to some people. One of the adverse effects is the loss of the natural attraction of River Musi which separates the old from the new city of Hyderabad(Huang.A 2006)

Table1: Solid waste generated and disposed by administrative division in Hyderabad.

Circle	Total waste generated per day in metric tonnes	No. of Vehicles	Total waste lifted per day	Waste left over per day
1	181	28	164	17
2	117	23	96	21
3	238	25	184	54
4	144	21	106	38
5	131	14	110	21
6	150	16	130	20
7	210	27	150	60
Total	1171	154	940	231

(Source: Snel, 1997)

Table.2 Solid waste generated in M.T in the year 1994 & 2011.

Sl.No	Solid waste generated (M.T/day)in 1994	Solid waste generated in (M.T/day) in 2001
1	181	370
2	117	372
3	238	234
4	144	206
5	131	402
6	150	48
7	210	590

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COMPARATIVE ANALYSIS FOR THE MAJOR CITIES OF NATIONAL AND INTERNATIONAL SCENERIO OF SOLID WASTE MANAGEMENT

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ABSTRACT

Municipal Solid Waste Management (MSWM) is one of the major environmental problems of Indian and International scenario of the world. Solid waste generated by the daily activities of the people needs to be properly managed in such a way that it minimizes the risk to the environment and human health. Site suitability analysis for resource collection and disposal requires an integrated approach and can be addressed most economically an efficiently using geospatial technology. In the present study, an attempt has been made to provide a comprehensive review of the characteristics, generation, collection and transportation, disposal and treatment technologies of Municipal Solid Waste practiced in India. The study carried out to evaluate the current status and identify the major problems. The study is concluded with fruitful suggestions, which may be beneficial to encourage the competent authorities to work towards further improvement of the present system.

Keywords: Solid waste, Comprehensive & Comparison etc

I. INTRODUCTION

Solid waste generated by the daily activities of the people needs to be properly managed in such a way that it minimizes the risk to the environment. The risk problems facing society today have many characteristics that complicate the application of formal analysis (Merkhofer 1987). The Solid Waste Management process includes collection, transportation and disposal. The observed trend of waste material is a continually growing issue of concern not only at local or regional levels but also at the larger global level. Each city produces tonnes tonnes of solid wastes daily from households, hospitals, industry offices, market centres etc. Some of these are biodegradable some are non-biodegradable and hazardous waste. The increased consumption of electronic items and IT hardware increased obsolescence rate of these products, which will results in the higher generation of electronic waste (e-waste). This waste is ultimately thrown into municipal waste collection centres from where it is collected to be further thrown into the landfills and dumps. With the increase in population, urbanization and economic development, there has been a significant increase in municipal solid waste generation in Hyderabad making its management and disposal a problem. Municipal Solid Waste Management (MSWM) is one of the major environmental problems of Indian cities. The management of municipal solid waste (MSW) is a high priority issue for many communities throughout the world including India.

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An Appraisal and Sustainability Trends of Municipal Solid Waste Management And Proposed Collection Point for Circle 8 of Hyderabad City

KEYWORDS: Geographical Information System; Solid waste management; Hyderabad urban agglomeration, Municipal wards; Greater Hyderabad Municipal Corporation

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ABSTRACT *Waste is a major health hazard with a very high potential to undermine people's right to life, and a threat to the environment. In India, waste is generally littered on roadsides and mostly dumped in the outskirts of the cities in areas that are low lying without compliance with the regulations. Proper and sustainable waste management can be achieved through the establishment of appropriate channels for the collection, transportation and disposal of wastes. The aim of this study was to find out the sustainability scenario of solid waste management with respect to the rising population in the city of Hyderabad. The use of Geographical Information System (GIS) was of great essence in classifying the city into sustainability classes based on the grouping of different municipal wards based on the per capita waste generated by each. It was generally found out that a bigger percentage of the municipal wards are low in sustainable waste management.*

1.INTRODUCTION

Before introducing solid waste management, it is prudent to begin the discussion with outlining the scope of solid waste, the material to be managed. Solid waste refers to the range of garbage arising from animal and human activities that are discarded as unwanted and useless. Solid waste is commonly generated from industrial, residential and commercial activities in a given area. As such, landfills are typically classified as sanitary, municipal, construction and demolition or industrial waste sites. Waste can be categorized based on its contents, including such materials as plastic, paper, glass, metal, and organic waste; based on its hazard potential, including categories such as radioactive, flammable, infectious, toxic, or non-toxic; or based on its origin, characterized as industrial, domestic, commercial, institutional or construction and demolition (Ohri.A 2010).

The management of municipal solid waste is a high priority issue for many communities throughout the world including India. The observed trend of waste material is a continually growing issue of concern not only at local or regional levels but also at the larger global level. The increased growth rate of the IT and electronics industry in India is propelled by increased consumption of electronic items and IT hardware, and it leads to higher generation of electronic waste (e-waste). Deciding where to locate a municipal sanitary landfill is a difficult problem in which qualitative criteria compete with quantitative, economic and engineering criteria in a process that is highly political and emotional. Site suitability analysis for resource collection and disposal requires an integrated approach and can be addressed most economically and efficiently using geospatial technology. In order to manage the Solid Waste Management properly in different aspects, GIS is a tool it provides a means of rapid data access and query based on both geographic location and attribute data (HBSHD 2011).

2.STUDY AREA

The present study area was chooses as Hyderabad city. Hyderabad is the 5th largest city in India. It has twin cities viz., Hyderabad and Secunderabad with its suburbs extending up to 16 miles. The Hyderabad city is situated in 17d 18'30" & 17d 28'30" North Latitude and 78d 22'30" & 78d 32'30" East Longitude. The study area covers an area of 179 Sq.Km. The total population of the district according to 2011 Census is 38,29,753 which is purely urbanised.

3.STUDY OBJECTIVE

- To map the population density and solid waste characteristics of the municipal wards of Hyderabad
- To determine the main sources of waste generators and waste characteristics in Hyderabad
- To determine the sustainability ratings of municipal wards of Hyderabad and the expected future waste generation trends

4.DATA USED

The study made use of data gathered from the Greater Hyderabad Municipal Corporation. The data included population information of Hyderabad municipal wards, volumes of waste generated and the predicted future trends in waste management. The data obtained was fed into GIS software for the generation of spatial maps to show the population distribution and the extent of waste management in various wards.

5.METHODOLOGY

DATA USED

The following data was used for the study.

Spatial Data:-

- Topographical maps of 56k/7 and 56k/11 from Survey of India in the form of hard copy at 1: 50000 scale
- Maps of Greater Hyderabad Municipal Corporation showing different circles with ward details in the form of hard copy.
- www.ghmc.gov.in.

Non spatial data:-

- Census of India for Hyderabad city containing information about population of different wards, No. of households etc.,
- Hand Book of Statistics Hyderabad District 2011.

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Evaluation of Land Use Planning, Transport Scenario with Reference to Express Highways in and Around Hyderabad City, Telangana

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Abstract: ***Transport planning is intrinsically linked to land use planning and both need to be developed together in an integrated manner. In developing such plans, attention should also be paid to the future growth of the city. Transport plans should, therefore, enable a city to take an urban form that best suits the geographical constraints of its location and also one that best supports the key social and economic activities of its residents.***

Keywords: Land Use, Transport, Express Highways, GIS.

1. Introduction

The Transportation concept is one such growth/ development strategy to assist the City in implementing the guiding principles of the Land Use Element. In the TOD strategy, new moderate and high density housing as well as new public uses and a majority of neighbourhood-serving retail and commercial uses will be concentrated in mixed-use developments located at strategic points along the regional transit system. This linkage between land use and express highways is designed to result in an efficient pattern of development that supports a regional transit system and makes significant impact in reducing traffic congestion and urban sprawl.

The mixed-use of land for residential and commercial activities, designed to minimize the need for transport and maximize the access to public transport, and often incorporates features to encourage transit ridership. A neighbourhood typically has a centre with a train/transit station, metro station, monorail station, tram stop, or high capacity bus stop, surrounded by relatively high-density development with progressively lower-density development spreading outwards from the centre.

2. Study Area

Hyderabad City is situated in the river Musi and Krishna basin, which is a tributary of river Krishna, passes through the city and bifurcates it into Northern and Southern Hyderabad. It is situated between 78022'30" & 78032'30" east longitude & between 17018'30" & 17028'30" north latitude. The ground levels vary from 487 meters to 610 meters above mean sea level (B.Purushothama Reddy 2004).

3. Land Use Management

According to LU.LC map, the proposed residential use is 46.05%. The proposed usage under public and semi-public zone is 10.10% and makes a total of 14.84% including 4.83% of defence area. A total area of 8.8 sqkm constituting 5.10% has been proposed under Multipurpose use zone. As per statistics, this zone comprises the existing mixed development areas, commercial hubs, residential, commercial and public and semi-public usages. Including rocks and hillocks a total of 12.7 sq.km constituting 7.36% of total area has been proposed under Open spaces, parks and playgrounds. A total area of 20.52 sq.km constituting 11.49% has been proposed under transportation land use category.

Original Research Paper Engineering

ENVIRONMENT IMPACT ANALYSIS AND SOCIAL EVALUATION FOR LONG TERM TRANSPORTATION IN HYDERABAD, TELANGANA

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ABSTRACT Environment and social evaluation can be carried out as part of the Long Term Transportation Strategy for the study area to understand the sustainability of the strategy and its likely implications on the environment and social conditions of the region. The evaluation has been carried out for the identified network development and for alternative scenarios. Good transport planning should be more than just engineering and should encompass other important considerations such as land use planning, energy efficiency, emission characteristics, traffic management, human behavior, economics, finance, public policy, governance, health, safety, gender, disability, affordability

KEYWORDS : Environment, Transportation, Sustainability etc.

1. INTRODUCTION

Environmental conditions in study area have to be understood in context of the growing urbanisation and industrialisation of the fringe areas coupled with slow pace of infrastructure development. The study area in general exhibits deterioration of environmental conditions in the core areas i.e., cluster 1 to 6 while rest of the clusters are following the trend of deterioration. The deterioration is closely followed by rapid urbanisation and lack of physical infrastructure.

The major environmental implications of the urbanisation as observed in the region has been increase in air pollution levels, increase in ground and surface water pollution, high noise levels, reduction of water bodies and declining levels of ground water. These are simultaneously associated with urban stress and increasing migration patterns. Hence it is important to understand the social conditions as well in order to appreciate the environmental conditions in the region in a coordinated manner.

2. STUDY AREA

Hyderabad City is situated in the river Musi and Krishna basin, which is a tributary of river Krishna, passes through the city and bifurcates it into Northern and Southern Hyderabad. It is situated between 78022'30" & 78032'30" east longitude & between 17018'30" & 17028'30" north latitude. The ground levels vary from 487 meters to 610 meters above mean sea level (B.Purushothama Reddy 2004).

3. RESULTS AND DISCUSSIONS

3.1 ENVIRONMENT CONSIDERATION IN TRANSPORTATION STATERGIES

Environmental conditions in the study area are observed in the context of the project interventions and likely environmental implications instead of conducting an overall inventory of environmental conditions of the region. The main parameters considered to be impacted for these research project interventions are studied in detail and their existing condition is established. The parameters considered to have implications from the project are as below:

- Environmentally Sensitive Areas
- Water Bodies
- Forests
- Sanctuaries
- Air Pollution
- Water Pollution
- Energy Efficiency

3.2 ENVIRONMENTALLY SENSITIVE AREAS

The study area boundary is dotted with several water bodies, vegetated areas, forests, three national parks, and a deer park. The areas that are susceptible to major ecological changes are the Water Bodies that are scattered all through the area. While the major water bodies as Osman Sagar and Himayat Sagar are used as drinking water sources and reservoirs for storage for Hyderabad drinking needs, rest of the water bodies are used for local domestic needs or for sullage disposal. Some of the water bodies that are located close to industrial areas are receiving industrial effluents as well. Only few water bodies are preserved in thier natural state with water that is suitable for domestic needs. In order to protect the water bodies in the catchment areas of drinking water sources, GoT has issued directives to notify the area surrounding the Osman Sagar and Himayat Sagar as Conservation areas with limited intervention for development.The area is dotted with several vegetated areas but with few forest patches notified as Reserve Forests. These are open forests with low vegetation cover except near few locations as near Vikarabad and its surroundings where moderately dense forests are found.

a) Air Pollution

Ambient air quality of the project area is deteriorating with the increase in population, traffic and industrial activities. The ambient air quality as monitored by the Pollution Control Board in about 10 locations in and around Hyderabad indicates high levels of particulate pollution.

An observation of the above table indicates that the RSPM levels at all locations are higher by 2 to 3 times the National Standards for annual average levels. Similarly the SPM levels are also higher by 2 to 3 times. The SO2, NO2, and Ammonia levels at all locations are lower than the NAAQS. NO2 levels are approaching the national standards indicating increase in pollution from vehicular traffic which is to be controlled prior to their escalation.

b) Water Pollution

Water quality in the water bodies in and around Hyderabad have been deteriorating rapidly due to increase of human activity and discharge of sullage. These water bodies though are to a large extend polluted, they form a major part of the fresh water reserves in the area and are potential recharge areas for ground water.

Location of Co-Ordinates with Reference to Circle Numbers: Hyderabad City

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INTRODUCTION

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The present study area was chooses as Hyderabad city. Hyderabad is the 5th largest city in India. It has twin cities viz., Hyderabad and Secunderabad with its suburbs extending upto 16 miles. The Hyderabad city is situated in 17d 18'30" & 17d 28'30" Northe Latitude and 78d 22'30" & 78d 32'30" East Longitude. The study area covers an area of 179 Sq.Km. The total population of the district according to 2001 Census is 38,29,753 which is purely urbanised.

METHODOLOGY

DATA USED

The following data was used for the study.

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- Maps of Greater Hyderabad Municipal Corporation showing different circles with ward details in the form of hard copy.
- Fused data of IRS-ID PAN and LISS-III satellite imaginary from National Remote Sensing Agency (NRSA), Hyderabad.

Durability Study on Fly Ash Aggregate Concrete with Respect to Carbonation Test

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Abstract:

In this project, the durability of concrete with fly ash aggregates (FAA) is studied. M20 Grade concrete is selected and designed as per IS method. The project's major goal is to use (FAA) fly ash aggregates to replace traditional fine and coarse aggregates. Cement and fly ash are mixed in proportions of 10:90, 12.5:87.5, 15:85, 17.5:82.5, 20:80, and 22.5:77.5 to make fly ash aggregates. The specimen cubes will be caste and tested for corrosion depth, workability, pull out strength and pH value of concrete at the end of 7, 14 and 28-days curing. Fine aggregate and coarse aggregates were substituted with fly ash aggregates in all of these experiments. From the results, the conclusions were drawn.

Keywords: Fly Ash Aggregates, Fine Aggregate, Coarse Aggregates, Strength.

I. Introduction

Concrete is a combination of cement, sand, aggregate, and water that is homogeneous. It is extremely strong in bearing compressive pressures, and as a result, it is becoming increasingly popular as a building material across the world. As the circumstance requires, use of available materials for concrete production and their characteristics in both fresh and hardened phases. In the past, most structures were built out of brick, steel, or wood, depending on the resources available and the nature of the job; however, concrete has recently become a popular building material.

Concrete has achieved such prominence in such a short time that it now accounts for more than 65 percent of all new structures being built across the world. Similar to other constituents, coarse aggregate is an essential factor to consider when producing better concrete; it has an impact on concrete strength, and this report will track the importance and impact of coarse aggregate on concrete strength.

Fly Ash

Fly ash is one of the wastes produced during coal burning. Fly ash is usually collected from power plant chimneys, although it can also be found at the bottom of the furnace. Fly ash used to be discharged into the atmosphere through the smoke stack, but pollution control technology specified in recent decades now requires it to be collected before being released. Most electric power production facilities in the United States store it on-site.

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Original Research Paper Engineering

Environmental Impacts and Their Effects on Various Enterprises

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KEYWORDS :

INTRODUCTION

The process of evaluating the likely environmental impacts of a development or proposed is known as Environmental Impact Assessment (EIA), taking into account inter-related socio-economic, human health and cultural, both beneficial and adverse.

UNEP defines Environmental Impact Assessment (EIA) as a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers. By using EIA both environmental and economic benefits can be achieved, such as reduced cost and time of project implementation and design, avoided treatment/clean-up costs and impacts of laws and regulations.

Although legislation and practice vary around the world, the fundamental components of an EIA would involves Screening, Scoping, Assessment and evaluation of impacts and development of alternatives, Reporting the Environmental Impact Statement (EIS) or EIA, Review of the Environmental Impact Statement (EIS), Decision-making and Monitoring, Compliance, enforcement and environmental auditing.

TYPES OF ENVIRONMENTAL IMPACTS:

1. Direct Impact,
2. Indirect Impact,
3. Cumulative impacts and
4. Induced Impact

Direct Impacts:

These impacts occur through direct interaction of an activity with an environmental, economic component or social.

For example, a discharge of any industry or an effluent from the Effluent Treatment Plant (ETP) from the industrial estates into a river may lead to a decline in the quality of water in terms of Dissolved Oxygen (DO) or rise of water toxins.

Indirect Impacts:

These impacts on the environment, which are not a direct result of the project, often produced away from or as a result of a complex impact pathway. Secondary or even third level impacts are also known as Indirect Impacts.

For example, ambient air SO_2 rise due to stack emissions may deposit on land as SO_4 and cause acidic soil. Another example of indirect impact is the decline in water quality due to rise in temperature of water bodies receiving cooling water discharge from the nearby industry.

This may, in turn, lead to a secondary indirect impact on aquatic flora in that water body and may further cause reduction in fish population. Reduction in fishing harvests, affecting the income of fisherman is a third level impact. Such impacts are characterized as socioeconomic (third level) impacts.

The indirect impacts may also include growth- inducing impacts and other effects related to induced changes to the pattern of land use or additional road network, population density or growth rate (e.g. around a power project). In the process, air, water and other natural systems including the ecosystem may also be affected.

Cumulative Impacts:

Cumulative impact consists of an impact that is created as a result of the combination of the project evaluated in the EIA together with other projects causing related impacts. These impacts occur when the incremental impact of the project is combined with the cumulative effects of other past, present and reasonably foreseeable future projects.

Induced Impacts:

The cumulative impacts can be, due to induced actions of projects and activities that may occur if the action under assessment is implemented such as growth inducing impacts and other effects related to induced changes to the pattern of future land use or additional road network, population density or growth rate. Induced actions may not be officially announced or be part of any official plan. Increase in workforce and nearby communities contributes to this effect.

They usually have no direct relationship with the action under assessment and represent the growth- inducing potential of an action. New roads leading from those constructed for a project, increased recreational activities, and construction of new service facilities are examples of induce actions.

However, the cumulative impacts due to induced development or third level or even secondary indirect impacts are difficult to be quantified. Because of higher levels of uncertainties, these impacts cannot be normally assessed over a long time horizon. An EIA practitioner usually can only guess as to what such induced impacts may be and the possible extent of their implications on the environmental factors.

ENVIRONMENTAL IMPACTS:

There are two main types of Environmental impacts.

1. ENVIRONMENTAL EFFECTS OF NUCLEAR POWER GENERATION
2. Environmental Impacts of Solar Power

ENVIRONMENTAL EFFECTS OF NUCLEAR POWER GENERATION

A nuclear power plant starts disturbing the environment during construction, and is common problem to any major enterprise, as for example, a non-nuclear power plant. Normal processes of plant construction as well as ancillary operations, not necessarily related to the nuclear nature of the power plant fuel, do disturb the surrounding environment. New roads, increasing traffic flow in the existing roads, excavations, cutting trees and other plants, frightened animals, are some of the environmental impacts to be expected from the construction of a power plant. In the case of a hydroelectric plant a large man-made lake which will replace free-flowing rivers is also to be built. In addition to all these impacts the builders of power plants should minimize, under the guidance of the legally competent authorities, disturbance to any prehistoric petrified plants and animals or to any archaeological remains of early civilizations, graveyards, monuments, ruins, aqueducts and so on. Site selection for nuclear power plants should be carefully made to avoid, or minimize to the extent possible, most of these impacts.

2. Environmental Impacts of Solar Power

Land Use

Water Use

Experimental Investigation on Cement Concrete with Partial Replacement of Sand by Waste Granite Powder

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Abstract

In modern days concrete made with cement is probably the most widely used artificial material in the world. Despite this fact, concrete production is one of the concerns worldwide that impact the environment with a huge impact being global warming due to carbon dioxide emission during the production of portland cement. On the other hand, when industrial wastes are recycled or reused, Carbon dioxide(CO_2) emissions are reduced and a small amount of material is dumped in a landfill and natural resources are saved. Therefore an attempt is made to replace the cement with granite powder in concrete. In this study, the possibility of using granite powder with cement on the performance of fresh and hardened concrete. In this experimental study, granite powder is used in concrete as cementitious material a partial replacement of cement. The replacement of cement was made by the level of 6%, 12%, and 20% by weight of cement. For each replacement, a compressive strength test was conducted. Compressive strength after 7days, 14days, and 28 days curing was done. From the test results, it was found that concrete at the level of 20% partial replacement of cement with granite powder had better workability and strength of 14 days and 28 days curing. The granite powder is available easily and is free of cost. So it seems to be economical.

Keywords: Artificial materials, Global warming, Granite powder.

I. INTRODUCTION

Going away from the waste materials to the general condition directly can cause conditions hard question for this reason the use again of waste material has been emphasized. Waste can be used to produce new products or can be used as admixtuires so that natural resources are used more with small amount of support and the general conditions is kept safe from waste money put in bank. It is put a value on that stone-like paste producing is responsible for about 3% of the complete anthrogenic greenhouse gas emission and for 5.25% of the complete anthrogenic C_{O2} emission. As about 50.48% of the CO_2 given out during stone like building paste producing is related to the breakdown of limestone during burning, mixing is taken into account as a very working well way to get changed to other from CO_2 emission.

The move-forward of common building material technology can get changed to other form the using up of natural resources and powder for a given time starting points and make less the weight down of pollutants on general condition. Presently greatly sized amounts of granite powder are produced in natural stone processing plants with an important force of meeting blow on general condition and humans. This undertaking gives a detailed account of the able to be done of using the granite thick, soft, wet mix of the

MAPPING OF CONCENTRATION OF POSITION VECTORS FOR ALL THE 18 CIRCLES: HYDERABAD CITY

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ABSTRACT:

The aim of this article deals with Study area of Hyderabad and Secunderabad municipalities. Present study area consists of 18 circles. Data used for conducting this study is its population, Total road network in KM and existing dumping places and Intermediate Transit Points. Finally this paper aims to work on Assigning all the nearest solid Waste Collection points of the study area and its optimal Road network.

INTRODUCTION

Solid waste management is an essential service. Before introducing this process, however, let's start with a discussion of the Solid waste material being managed at various levels.

It mainly refers to the wide range of garbage materials—arising from human activities and animal —that are to be discarded as unwanted and useless. Solid waste is generated from residential, industrial, and commercial activities in a given area, and it can be handled in various ways. As such, landfills are typically classified as municipal, construction, sanitary and demolition, or industrial waste sites.

Waste can be categorized based on material, such as paper, glass, plastic, metal, and organic waste. Categorization may also be based on hazard potential, including flammable, radioactive, infectious, toxic, or non-toxic wastes. Categories may also pertain to the origin of the waste, whether industrial, domestic, commercial, institutional, or construction and demolition.

Regardless of the origin, content, or hazard potential, solid waste must be managed systematically to ensure environmental best practices. As solid waste management is a critical aspect of environmental hygiene, it must be incorporated into environmental planning.

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Research Paper

Improvement in the computational efficiency of the coupled FEM–SBFEM approach for 3D seismic SSI analysis in the time domain

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ABSTRACT

The scaled boundary finite element method (SBFEM) is an attractive approach for modelling unbounded media because it offers the advantages of both the finite element method (FEM) and the boundary element method (BEM) avoiding their respective drawbacks. Unfortunately, being a rigorous method, the SBFEM exhibits non-locality in both time and space, which results in significant numerical effort, especially for large problems with many degrees of freedom and a long simulation time. In order to improve the performance of this method, two different approximation techniques – one in time and one in space have been combined and implemented in the present work. A three-dimensional embedded footing problem was solved for the dynamic load, including a chirp load and a sinusoidal load. The combination of the two approximation techniques implemented in the time domain-coupled FEM–SBFEM approach for 3D analysis leads to significant reduction in computational time and storage requirements with insignificant loss in accuracy. The computational time required for the approximation techniques was found to be only 5% of that required using the conventional method, whereas the loss in accuracy was found to be less than 5%. Further, numerical problems for the externally applied dynamic load as well as the seismic load demonstrate the applicability of the coupled FEM–SBFEM approach for modelling dynamic soil–structure interaction (SSI) problems.

1. Introduction

Efficient yet accurate modelling of the unbounded soil medium has been of long-standing interest in the research addressing dynamic soil–structure interaction (SSI) problems. In the substructure method of dynamic SSI analysis, rigorous modelling of the unbounded domain is performed. Some of the established rigorous procedures used in the substructure method of analysis are the boundary element method (BEM) [1], the thin layer method [2], the exact non-reflecting boundary conditions [3], the consistent infinitesimal finite element cell method (CIFECM) [4] and the scaled boundary finite element method (SBFEM) [5]. Although the BEM satisfies the radiation condition exactly while dealing with unbounded domain problems, its application to practical problems is limited because the complexity of the fundamental solution satisfying the integral equation of motion increases dramatically while addressing certain types of problems, e.g., problems with anisotropic materials. The thin layer method is applicable only for horizontally layered media resting on a rigid rock base. Similar to the BEM, the exact non-reflecting boundary conditions for unbounded domains demand exact solutions and hence are limited to problems with simple geometry and material properties. Combined models based on coupling of the finite element method (FEM) with different approaches, such as the FEM–BEM [6–8], the FEM–CIFECM [9,10], the FEM–SBFEM [11,12], and the FEM–BEM–SBFEM [13], have also been proposed.

The SBFEM combines the advantages of both the FEM and the BEM, avoiding their respective drawbacks [5]. It satisfies the radiation condition exactly and is based entirely on finite elements but with a discretization on the boundary only, thus reducing the spatial dimension by one. No fundamental solutions are required while implementing the SBFEM, and hence, it is suitable for problems with anisotropic material properties. The SBFEM has been used for problems such as elasto-statics and elasto-dynamics [5,14], fluid flow problems [15], fracture mechanics [16], and geomechanics [17]. Recently, the SBFEM has gained popularity as a tool, especially for SSI problems in unbounded domains [13,18,19].

The major drawback of the SBFEM is the tremendous demand that it exerts on the computational time and storage requirements.

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Verification of Implementation of HiSS Soil Model in the Coupled FEM–SBFEM SSI Analysis

B. K. Maheshwari, M.ASCE[1]; and N. M. Syed[2]

Abstract: The scaled boundary FEM (SBFEM) has become an attractive alternative to traditional rigorous methods available for modeling the unbounded media for soil–structure interaction (SSI) analysis using the substructure method. Most of the coupled FEM–SBFEM schemes available in the literature are only for the linear-elastic SSI analysis. Very few studies have considered the nonlinearity in the near-field, and most of them have adopted elastic-perfectly plastic models to simulate the nonlinearity. In the present study, an advanced plasticity-based model known as hierarchical single surface (HiSS)-δ_0, which is based on isotropic hardening and associated response, has been implemented in the coupled FEM–SBFEM scheme in the time domain. The HiSS model provides a general formulation for the elastoplastic characterization of the material behavior. Problems from the literature have been solved using the presently developed code, and the results have been verified, thus validating the developed code. **DOI: 10.1061/(ASCE)GM.1943-5622.0000511.**

Author keywords: Nonlinear soil–structure interaction; Radiation condition; FEM–SBFEM; HiSS model.

Introduction

The scaled boundary FEM (SBFEM) developed by Song and Wolf (1997) has been applied to many problems in engineering, including soil–structure interaction (SSI) analysis. The SBFEM offers the advantages of both the FEM and the boundary element method (BEM), evading their respective drawbacks, and hence, is an attractive alternative to other rigorous methods available for modeling the unbounded media for the SSI analysis (Wolf 2003). Combined models using the coupling of different approaches, such as the FEM–BEM (von Estroff and Prabucki 1990; von Estroff and Firuziaan 2000), the FEM-consistent infinitesimal finite-element cell method (CIFECM) (Emani and Maheshwari 2009; Maheshwari and Emani 2015), the FEM–SBFEM (Wolf and Song 2000; Bazyar and Song 2006; Syed and Maheshwari 2014a), the FEM–BEM–SBFEM (Genes and Kocak 2005), etc., have also been proposed.

In the FEM–SBFEM coupling, using the substructure method of SSI analysis, modeling of the bounded domain is performed by the FEM, whereas the behavior of the far-field is simulated by the SBFEM. Most of the coupled FEM–SBFEM schemes developed for the SSI analysis until now included only linear-elastic behavior, and very few studies have considered material nonlinearity in the near-field. Doherty and Deeks (2005) proposed an adaptive FEM–SBFEM coupling for a nonlinear near-field. In this technique, an additional layer of finite elements in the far-field region are added to the existing mesh of the near-field, if the Gauss point in the outer band of finite elements is yielded and the SBFE domain is stepped out accordingly. They adopted an ideal elastic–plastic Tresca model to simulate the material nonlinearity. Bransch and Lehmann (2011) used the nonlinear Hilber–Hughes–Taylor–alpha method (Hilber et al. 1977) with full Newton–Raphson iteration within the framework of the coupled FEM–SBFEM approach. They used the elastic–plastic cap model given by DiMaggio and Sandler (1971) to capture the nonlinearity in the near-field. Although the cap model has been used in the characterization of materials that exhibit continuous yielding, it suffers certain limitations in handling a number of important attributes of the behavior of materials (Desai 2001). Ooi et al. (2014) developed a scaled-boundary polygon formulation using polygon shape functions to model the nonlinear material responses in structures. However, they also used elastic-perfectly plastic nonlinearity using Tresca and von Mises yield criteria to simulate material nonlinearity.

In this paper, a more advanced plasticity-based model, known as the hierarchical single-surface (HiSS) plasticity model (Desai 2001), has been used to model the material nonlinearity in the near-field. HiSS models provide a general formulation for the elastoplastic characterization of the material behavior. They provide hierarchical adoption of models of increasing sophistication, say, linear elastic to nonassociated elastoplastic to elastoplastic with softening. Although HiSS is an advanced model, implementing it in a FEM code is simpler compared with other plasticity-based models, such as the cap model.

In this paper, the basic and simplest version of the HiSS models, the HiSS-δ_0, which allows for isotropic hardening and associated response, has been used in the dynamic SSI analysis carried out using the coupled FEM–SBFEM approach. The work presented in this paper is an extension of Syed and Maheshwari (2014b), where the verification shown for the nonlinear soil model was very limited.

Governing Equations and Numerical Solutions

The basic equations of motion in time domain of the unbounded medium–structure interaction for the prescribed dynamic loads as well as externally applied transient loading are given by (Wolf 1988)

$$\begin{bmatrix} M_{ss} & M_{sb} \\ M_{bs} & M_{bb} \end{bmatrix} \begin{Bmatrix} \ddot{u}_s^t \\ \ddot{u}_b^t \end{Bmatrix} + \begin{bmatrix} C_{ss} & C_{sb} \\ C_{bs} & C_{bb} \end{bmatrix} \begin{Bmatrix} \dot{u}_s^t \\ \dot{u}_b^t \end{Bmatrix} + \begin{bmatrix} K_{ss} & K_{sb} \\ K_{bs} & K_{bb} \end{bmatrix} \begin{Bmatrix} u_s^t(n\Delta t) \\ u_b^t(n\Delta t) \end{Bmatrix} + \begin{Bmatrix} 0 \\ R_b(t) \end{Bmatrix} = \begin{Bmatrix} P_s(t) \\ P_b(t) \end{Bmatrix} \quad (1)$$

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Non-linear SSI analysis in time domain using coupled FEM–SBFEM for a soil–pile system

N. M. SYED* and B. K. MAHESHWARI†

The scaled boundary finite-element method (SBFEM) coupled with the finite-element method (FEM) is increasingly being employed to study soil–structure interaction (SSI) problems. However, most of the coupled FEM–SBFEM models for dynamic SSI analysis include only linear behaviour of the soil in the near field. In the present work, a coupled FEM–SBFEM scheme is presented in the time domain for non-linear dynamic SSI analysis. An advanced plasticity-based model, namely the hierarchical single-surface (HiSS)-δ_0, is incorporated to simulate soil non-linearity. A three-dimensional single pile–soil system is solved for externally applied dynamic load as well as ground excitation. A parametric study is done to gain insight into the effects of soil stiffness and intensity of loading on the non-linear response of a single pile–soil system by calculating its dynamic impedances and kinematic interaction factors. Also, the displacement response at the pile head due to the El Centro earthquake is calculated for linear and non-linear cases.

KEYWORDS: numerical modelling; plasticity; soil/structure interaction

INTRODUCTION

The scaled boundary finite-element method (SBFEM), developed by Wolf & Song (2000) and Song & Wolf (2000) is being increasingly employed for modelling the unbounded domain in dynamic soil–structure interaction (SSI) problems (Zhang *et al*., 1999; Bazyar & Song, 2006; Wegner *et al*., 2009; Seiphoori *et al*., 2011; Syed & Maheshwari, 2014). The SBFEM combines the advantages of both the finite-element method (FEM) and the boundary-element method (BEM), evading their respective drawbacks (Wolf, 2003).

Ekevid & Wiberg (2002) employed a hybrid FEM–SBFEM scheme to study the dynamic response of a railroad. Borsutzky & Lehmann (2006) analysed the damage risk of buried lifelines considering the seismic wave propagation effects. Lin *et al*. (2007) carried out dynamic analysis of a dam–reservoir–foundation system employing the SBFEM for modelling of an unbounded medium. Seiphoori *et al*. (2011) carried out three-dimensional non-linear earthquake analysis of rockfill dams. They restricted the non-linearity in the rockfill material of the dam, whereas the unbounded medium was modelled using the SBFEM. Liu *et al*. (2012) carried out a dynamic response analysis of a two-dimensional dam–foundation–reservoir system in the frequency domain. Lo *et al*. (2012) adopted the coupled FEM–SBFEM approach to study the ground vibrations due to a pile-driving process into layered ground. Yaseri *et al*. (2014) employed the coupled FEM–SBFEM approach to study the effect of speed of an underground train on the ground response.

Most of the coupled FEM–SBFEM models for dynamic SSI analysis include only linear behaviour of the soil in the near field. However, Doherty & Deeks (2005) applied adaptive coupling of the FEM–SBFEM interface considering non-linearity in the near field. Bransch & Lehmann (2011) used the non-linear Hilber–Hughes–Taylor-α algorithm with full Newton–Raphson iteration within the framework of the coupled FEM–SBFEM approach to study a non-linear SSI problem. In all of the above works, non-linearity was restricted to the near field and the far field, which was modelled using the SBFEM, was assumed to behave linearly. Lin & Liao (2011) combined the traditional SBFEM with the homotopy analysis method (HAM) extending the conventional SBFEM to non-linear differential equations, thus enabling modelling of the far field with a non-linear material as well.

Doherty & Deeks (2005) in their study modelled the near field with an ideal elastic–plastic Tresca material, whereas Bransch & Lehmann (2011) employed the elastic–plastic cap model given by DiMaggio & Sandler (1971). Although the cap model has been used in the characterisation of materials that exhibit continuous yielding, they suffer certain limitations in handling a number of important attributes of the behaviour of materials, such as the non-associative response of many frictional materials (Desai, 2001). The hierarchical single-surface (HiSS) plasticity models provide a general formulation for the elastoplastic characterisation of material behaviour. They provide hierarchical adoption of models of increasing sophistication, say, linear elastic to non-associated elastoplastic to elastoplastic with softening. In the present work, the basic and simplest version of the HiSS models, the HiSS-δ_0 model, which allows for isotropic hardening and associated response, has been used to model the soil in the near-field region.

Syed & Maheshwari (2014) have presented modelling of seismic SSI using coupled FEM–SBFEM. Syed & Maheshwari (2015) reported the computational efficiency for the algorithm developed using the coupled FEM–SBFEM approach. Maheshwari & Emani (2015) employed the FE–CIFECM (finite element–consistent infinitesimal finite-element cell method) for modelling unbounded domain and the HiSS soil model to demonstrate the effect of material non-linearity of the soil. Recently, Maheshwari & Syed (2016) verified the implementation of the HiSS soil model in coupled FEM–SBFEM analysis.

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Liquefaction Potential of Sites in Kalyani Region based on Shear Wave Velocity Data

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Abstract
Liquefaction hazard is one of the most catastrophic effects of an earthquake. When dynamic loading occurs, saturated sandy soil in undrained conditions loses its shear strength due to the development of excess pore water pressure. Therefore, it is imperative to evaluate a site for its susceptibility to liquefaction. The main objective of the present study is to calculate the liquefaction potential of 6 sites in Kalyani region which are located at around 50 km from the City of Kolkata in the State of West Bengal, India. For this purpose, six bore locations are selected in the All India Institute of Medical Sciences, Kalyani, Kolkata Campus.

The liquefaction potential of the site is calculated at all the six locations for an earthquake of magnitude 7.5 and peak ground acceleration (PGA) of 0.16 g. The water table is considered at the ground level. Liquefaction potential in terms of Factor of Safety against liquefaction is calculated with the depth based on the shear wave velocity data. Further, liquefaction potential index is also evaluated for all the considered sites. It is observed that the possibility of liquefaction is very high at shallow depths. Moreover, a parametric study is carried out for various values of the magnitudes of earthquakes and PGA values to show its effects on liquefaction susceptibility.

Keywords: Peak Ground Acceleration, Shear Wave Velocity, Liquefaction Potential, Liquefaction Potential Index, SPT N Value, Seismic Hazard.

Introduction

Geotechnical investigation is carried out to identify the properties of the soil, where any major civil engineering structure is to be constructed. If the investigation is done for the site which comes under the earthquake prone areas then it is necessary to establish whether the given site is liquefiable or not. Standard Penetration Test (SPT), Cone Penetration Test (CPT), Becker Hammer Test (BHT) and Multichannel Analysis Surface Wave (MASW) Test are some of the field methods used to measure the liquefaction potential of soil. Earlier, the liquefaction potential of a site was calculated by the simplified procedure developed by Seed and Idriss[35] using the Cyclic Resistance Ratio (CRR) value obtained by N values of SPT. Since then, the method has been continuously reformed and simplified by various authors.[36-38,47]

Another popular method for the evaluation of the liquefaction potential using the CPT was given by Robertson and Campanella[32]. This method of evaluation has also been reformed and updated several times.[30,34,41]

The shear wave velocity (Vs) method for determination of the liquefaction potential is preferable over other methods such as SPT, CPT etc. because it is not affected by large particles and is less sensitive toward soil compression and reduced penetration resistance due to the presence of fines, thus requiring minor corrections.[31] It is also a non-destructive test and can be used both in the field and in the laboratory.[14,44]

In this method, shear wave velocity is considered as an index property of soil to determine liquefaction potential resistance. Both liquefaction potential resistance and shear wave velocity are similarly influenced by stress history, age of soil geology, void ratio and different states of stress.

In the last two decades, many researchers have given relationships between liquefaction potential resistance and shear wave velocity. They have used different methods like field test, penetration –Vs correlation, numerical investigation, laboratory experiments etc.[3,6,10,12,20,24,33,37,43,44] All these evaluations were based on the simplified procedure of Seed and Idriss[35] method. Several corrections have been applied to Vs for overburden stress and an analytical expression is established with Cyclic Stress Ratio (CSR). Several seismic tests have been used to measure shear wave velocity in the field like CPT, MASW, suspension logger, down-hole and cross-hole.[22,47] Sensitiveness of the calculation and condition of soil are highly affected by the precision of the tests. Stokoe et al[42] and Belloti et al[5] have shown that the velocity achieved by the shear wave is equally dependent on the motion of the particle and principal stresses.

The evaluation of liquefaction potential index (LPI) is required to mitigate the damages caused by liquefaction. Iwasaki et al[18] proposed LPI to overcome the limitations associated with Factor of Safety (FoS). LPI is frequently used by researchers to evaluate the liquefaction potential of soils. LPI offers an advantage by providing a single value for the entire location for liquefaction hazard maps instead of several factors at different layers.[11,40,46] LPI has been calibrated using SPT test data to characterize the liquefaction potential of sites.[11,29,40,45] Iwasaki et al[19] categorized levels of liquefaction severity as very low, low, high and very high

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ORIGINAL PAPER

Soil Liquefaction Potential of Kalyani Region, India

Sajjan Kumar[1] · **Pradeep Muley**[1] · **N. M. Syed**[2]

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Abstract High-magnitude earthquakes can result in severe destruction in regions susceptible to liquefaction. To avoid such casualty, one needs to specify the liquefaction susceptibility of the area and suggest proper measures for construction designs. In the present work, the liquefaction potential of the Kalyani region is evaluated. Three moderate- to high-magnitude earthquake scenarios (M_w = 6.5, 7.0, and 7.5 and $PGA = 0.143g$, $0.170g$, and $0.202g$, respectively) are considered for the present analysis at the six selected borehole sites in the study region. Liquefaction potential in terms of the factor of safety (*FoS*) against liquefaction is evaluated using a field approach based on *N* values with the help of a simplified method commonly known as Seed and Idriss method. Further, an attempt is made to define the severity against liquefaction by drawing the liquefaction hazard map of the study area based on the liquefaction potential index (*LPI*) values. It is found from the results that, for the shallow depths, susceptibility towards liquefaction decreases as the magnitude of earthquake decreases. We also observed that the minimum difference in the *FoS* obtained for a 7.0 magnitude earthquake was found to be 40% greater than that for the 7.5 magnitude earthquake. The same result is valid for the *LPI* analysis; for 7.5 M_w, the *LPI* is very high and the susceptibility towards liquefaction is about 93%. For the 7.0 M_w, the *LPI* is high and the severity against liquefaction is between 58 and 93% probability, whereas for 6.5 M_w, the *LPI* is moderately high with less than 53% susceptibility towards liquefaction.

Keywords Liquefaction · Liquefaction potential index · Cyclic stress ratio · Cyclic resistance ratio · Factor of safety

Introduction

Whenever a major earthquake occurs, it is observed that it causes serious damage to the foundation, structure, and underground structure constructed on the extensive areas of reclaimed land due to soil liquefaction and displacement of ground in the horizontal direction [1]. It has been shown that the determination of liquefaction potential of any region must be taken into account for ground improvement before the construction of any structure [2]. When a high-intensity earthquake hits a sandy soil deposit which is in loose, saturated, and undrained cohesionless condition, then the rapid decrease in the shear strength of the soil takes place such that the shear strength of the soil eventually becomes zero. This phenomenon is termed as liquefaction. As the pore water pressure increases, soil particles lose their contact with each other and move in unidentified directions resulting in sinking of heavyweight structures and floating of low-weight structures. The occurrence of soil liquefaction depends on various factors like the type of soil, thickness of the soil strata, soil grain size, relative density, water table depth, fines content, etc. [2]. Correspondingly, severity of liquefaction is influenced by the reduction of effective stress, shear modulus degradation, and intensity and magnitude of the earthquake, duration of the ground motion, distance from the source of the earthquake, ground acceleration, etc. [2–4]. Ground

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Ground response analysis and liquefaction for Kalyani region, Kolkata

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Abstract
The main focus of this research is the ground response analysis and liquefaction potential analysis of AIIMS Kolkata based on SPT-N values at six different locations. The analyses are performed for the earthquake magnitude $M_w = 7.0$ and peak ground acceleration of 0.170 g. For this, Equivalent-linear Earthquake Response Analysis (EERA), Nonlinear Earthquake Response Analysis (NERA), and PLAXIS-2D software are utilized. In ground response analysis, various parameters such as shear stress, peak ground acceleration, relative displacement, and amplification ratio are evaluated. In liquefaction potential analysis, the factor of safety against liquefaction is calculated from different methods, such as the simplified method, EERA, and NERA, and their results have been compared. Further liquefaction potential index is also evaluated for the same earthquake magnitude and PGA using the factor of safety value evaluated from liquefaction potential analysis and ground response analysis for all the borehole locations. It is observed from the results that the equivalent linear analysis gives conservative results when compared with those obtained from the nonlinear analysis. Moreover, the simplified method too fails to predict the liquefaction susceptibility of certain regions that are found to be prone to liquefaction from the EERA and NERA analyses.

Keywords Liquefaction potential · Equivalent linear and nonlinear earthquake response · CSR · CRR · Factor of safety

Introduction

It has been shown by various researchers that the study of ground motion during an earthquake is essential to determine its effect on the structures constructed on soft soils. In the list of hazardous phenomena, earthquake always has severe effect as compared to others, and over the last many decades, the loss of lives and property due to earthquakes are uncountable. Kolkata is one of the metro cities lying on the eastern coastal belt (Putti and Neelima 2018). It is a highly populated city and has a population of approximately 4.5 million over the approx. area of 185 km^2 (Roy and Sahu 2012a, b). Since the city is very old and largely has unplanned development, there are many high-rise buildings constructed in congested areas, increasing the risk of loss several times in the event of a major earthquake. Kalyani is also one of the ancient parts of the Nadia district which lies in seismic zone III according to IS 1893–2016. The regions in this zone are considered susceptible to liquefaction. Considering the importance of the city in terms of seismic history, population density, and growth of public sectors, the authors were motivated to carry out the present research work.

Linear and nonlinear analyses are employed in the prediction of ground motion at the surface for the development of design response spectra. They are also used to calculate the stresses and strains which are again used in the assessment of liquefaction potential (Kramer 1996).

Many researchers have carried out linear and nonlinear analyses for various urban locations of the world (Schnabel et al. 1972; Idriss & Sun 1992; Kramer 1996; Sugito et al. 1994; Assimaki et al. 2000). Several site-specific studies have also been performed for various sites like Santiago de Cuba (Alvarez et al. 2004, Zagreb (Herak et al. 2004), Bursa (Topal et al. 2003), Algiers (Harbi et al. 2004), Alexandria (El-Sayed et al. 2004), Beijing (Ding et al. 2004), and Napoli (Nunziata 2004). Various comparative studies on linear and nonlinear analysis have also been conducted (Youd & Carter 2005; Zeng

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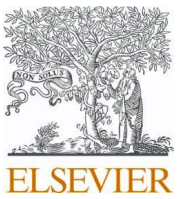

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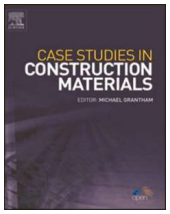

Performance evaluation of ternary blended geopolymer binders comprising of slag, fly ash and brick kiln rice husk ash

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A R T I C L E I N F O

Keywords:
Ternary geopolymer
Slag
Fly ash
Rice husk ash
Sustainability

A B S T R A C T

The use of industrial and agro-based precursor materials from local sources can achieve desirable properties for geopolymer binders, and thus realize the carbon-efficient sustainable materials in the construction industry. At the same time, the synergy between these precursors can be assessed using the multilevel material investigation, which has not been explored extensively. Moreover, there are limited studies on ternary geopolymer synthesized with rice husk ash from uncontrolled burning source such as brick kilns. Therefore, this study evaluates the performance of ternary blended geopolymer binders comprised of ground granulated blast furnace slag (GGBFS), fly ash (FLA), and brick kiln rice husk ask (BRHA), implementing the multilevel material approach. The experimental program includes assessment and comparative analyses of the properties of geopolymer binders such as setting time, flow, compressive strength, density, water absorption, and efflorescence. Additionally, X-ray diffraction (XRD) and scanning electron microscopy (SEM) analyses examine crystallographic structure and microscopic morphology of the composite binders. The initial setting time ranged from 21 min to 47 min for ternary mixes, in comparison to 21 min to 58 min for binary mixes. GGBFS significantly contribute in setting of binder due to hydration reaction and formation of C-S-H gel. The flow of ternary mixes exhibits standard deviation of 11.42 mm when compared to 20.96 mm of binary mixes. Lower dispersion in flow values suggests improved coaction between GGBFS, FLA, and BRHA. The compressive strength of ternary mixes improved when compared to the binary mixes. The optimum performance of 60 MPa was obtained for G60A40F95R5, which was 25% and 66.67% higher than binary mixes G60F40 and G60R40, respectively. Similarly, ternary mix G70A30F95R5 showed the least water absorption of 2.08% which was 53% and 58.4% lower than the binary mixes G70F30 and G70R30, respectively. The improvement in the properties of ternary mixes was confirmed from XRD analysis, which reveal coexistence of C-S-H along with crystalline SiO_2 that positively improve the microstructure of the composite binder. Moreover, SEM analysis showed dense microstructure for ternary mixes when compared to binary mixes, which further validate the improvement in the strength of such binders. The sustainability analysis discloses the enhanced performance of ternary mixes, wherein, G60A40F95R5 showed 19.35% and 46.23% lower carbon dioxide parameter than binary mixes G60F40 and G60R40, respectively. All in all, the multilevel material investigation provides a great avenue to delve in to the best performing ternary mixes which will find desirable applications in construction industry.

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Radar Signal Design for Single Target Detection

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Abstract: *A novel design approach has been proposed to evaluate the detection ability of a target using poly-semantic sequences (PSS) in the presence of high additive noise. The PSS are optimized by employing Hamming Backtrack algorithm with figure of merit as the measure of goodness. The simulation results show that the proposed sequences give improved robustness of noise for target detection.*

Keywords: *Hamming Backtrack Algorithm, Poly-Semantic Sequences, Optimal Binary Codes.*

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I. Introduction

The notion of poly-alphabetic radar [1],[2] introduced earlier based on simultaneous multiple interpretations of pre-designed returned waveform, results into improved detection performance of binary pulse compression radar at the affordable cost of an additional signal processing. In fact, the central idea of poly-alphabetic radar signal is poly-semanticism, which was achieved through poly-alphabetism. In the earlier work based on mono-alphabetic poly-semanticism [3], the problem of optimal target detection was discussed in the context of single target in noise free environment. In our approach, Optimal Binary Codes (OBC) and randomly generated mono-alphabetic codes are considered to generate poly-semantic sequences of larger lengths up to 5100. The receiver system is designed by considering single target with noisy environment. The quantitative measures; Discrimination (D) and Figure of merit (F) suggested by Moharir [4],[5] for binary sequences are used to evaluate the detection performance of the poly-semantic codes. The transmitted binary sequence is optimized by employing poly-semantic Hamming backtrack scan algorithm such that each of the poly-semantic interpretations lead to maximum discrimination or figure of merit. The generation of poly-semantic sequences and radar signal processor for application in high resolution radar target detection is discussed in sec II. The rest of this paper is organized as follows. Calculations of figure of merit are presented in section III. In sections IV and V, we present the noise and detection performances of poly-semantic sequences to obtain noise rejection with respect to figure of merit in the application of high resolution radar. Conclusions are made in section VI.

II. Poly-Semantic Radar Signal Processor

The generation of poly-semantic sequences is completed in two steps: first one using restricted (selective) Hamming backtrack scan for interspersed binary sequences and the second, using a complete Hamming backtrack scan for poly-semantic sequences with figure of merit as joint objective function. The block schematic diagram of poly-semantic radar signal processor at the transmitter is shown in Fig.1(a).

First Step in the Signal Design

Consider, optimal binary codes or randomly generated binary codes of length N, given by

$S_1 = A = [a_i]$ (1)

$B = [b_i]$ (2)

and $C = [c_i]$ (3)

where i = 0, 1 ,2, 3 , …, N-1.

The elements of these sequences are drawn from alphabet {-1, +1}.

The sequence S_1 is mutated using Hamming backtrack algorithm to get optimum figure of merit. The sequences S_2 of length 2N and S_3 of length 3N are generated by interleaving the elements of S_1 & B, and S_2 & C respectively as shown in Fig.1(a). Therefore

$S_2 = [a_i\ b_i]$ (4)

and $S_3 = [a_i\ b_i\ c_i]$ (5)

where i = 0, 1 ,2, 3 , …, N-1.

A selective Hamming backtracking algorithm [6] is applied on the sequences S_2 and S_3, so that the figure of merit of the output sequence is optimized. This algorithm performs mutations only on the embedded elements, *i.e.*, b_0, b_1, b_2, b_3 … of the sequence S_2, and c_0, c_1, c_2, c_3 … of the sequence S_3, without disturbing the other elements.

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Design Of High Speed Data Transmission Systems Using Cooperative Diversity Wireless Networks.

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Abstract: *Cooperative Diversity (CD) is a method in which different radio terminals deliver to each other for developing the total network channel capacity. We propose a high speed data transmission using efficient queuing system in wireless diversity networks. It provides the simultaneous data transmission of data for multiple users and increases the amount of data packets. To develop the robustness in ad hoc networks, the CD-MAC algorithm is introduced in the physical layer. The MIMO technique sends and receives the same data signal simultaneously on a single radio channel. OFDM is a frequency-division multiplexing scheme used to reduce the interference. The ALOHA in cooperative diversity has the drawback of low throughput under heavy load conditions and collision. It sends the messages any time they want. Introduction of Slotted ALOHA Buffer CD it is expected to add some more advantages reduce the delay and transmits data packets simultaneously for achieving the high channel utilization with less interference. Queuing is used to increase the coverage optimization. The Wireless Channel's broadband characteristics improve the ALOHA network protocol performance.*

Keywords: *Cooperative diversity, Channel capacity, Throughput, Outage probability.*

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I. Introduction

To develop the robustness in ad hoc networks, the CD-MAC algorithm is introduced in the physical layer. Distributed space-time/frequency coding scheme is introduced for improving the SNR. The end to end BER is decreased by considering two power allocation strategies between sources to relay. To develop the robustness in ad hoc networks, the CD-MAC algorithm is introduced in the physical layer. The efficiency and credibility of the cognitive system will be improved by introducing the spectrum, which will have the distinction of finding wrong and missed issues. Slotted ALOHA with buffer for delivering the data packets from one place to another place as well as retransmits the degraded packets from the transmission. The coalescence of Slotted ALOHA (S-ALOHA) and buffer is implemented for delivering data packets from one place to another. The combination of Slotted ALOHA (S-ALOHA) and buffer is implemented for delivering data packets from one place to another. This protocol is expected to improve the throughput, minimize the outage probability and delay for effective transmission from source to destinations. It provides the simultaneous data transmission of data for multiple users. The end-to-end SER probability is enhanced, when the Switched Selection Combining employed with the MPSK. To achieve the best SNR, the combination of the weighing vector and MRC technique is employed. Symbol Error Probability (SEP) is computed and then the diversity order is carried out for developing the confidential capacity of the network. A multiplier and forward two way multi-relay system is used for achieving the SNR and its Probability Density Function (PDF) for each transmission node. Performance and reliability of the cognitive system are improved by introducing the spectrum sensing a problem with diversity in detecting the false and missed probabilities. In MIMO, the co-operative communication is applied for enhancing the coverage and system capacity of wireless environments and its performance depends on a number of intermediate nodes. It is applicable only when the channel estimation error exists. The GBN-ARQ protocols are analyzed by the queuing model and it estimates queue length as well as delay statistics. GBN-ARQ is an error recovery protocol. Data after the delay range is useless. The existing algorithms have some constraints such as high delay and low throughput. In order to overcome these problems, the Slotted ALOHA Buffer CD (S-ALOHA-BCD) method is introduced. The S-ALOHA-BCD method used to improve the

AN EFFICIENT SIGNAL PROCESSING TECHNIQUE FOR LANDMINE DETECTION

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ABSTRACT

Landmines and unexploded ordinance (UXO) are laid during a contention against enemy powers. In any case, they slaughter or debilitate regular people a very long time after the contention has finished. There are in excess of 110 million landmines effectively held up in the globe. Consistently more than 26,000 guiltless regular people are slaughtered or harmed. Most present day landmines are for the most part non-metallic or plastic, which are hard to be distinguished utilizing regular metal identifiers. Location utilizing hand-held pushing is a moderate and costly procedure. Impulse Ground Penetrating Radar (ImGPR) is a nondestructive system fit for recognizing shallowly covered nonmetallic anti-personnel (AP) and anti-tank (AT) landmines. The nearness of solid ground mess and clamor corrupt the presentation of GPR. Henceforth, utilizing a GPR sensor is practically unimaginable without the utilization of advanced signal handling. In electromagnetic wave engendering displaying, a multilayer transmission line procedure is applied. It considers distinctive soil types at various dampness levels. Plastic focuses of various widths are covered at various profundities. The demonstrated sign is at that point used to evaluate the ground and covered target parameters. In a parameter estimation strategy, a surface reflection parameter technique (SRPM) is applied. Signal handling calculations are executed for mess decrease and basic leadership purposes. Consideration is for the most part given to the advancement of methods, that are appropriate to constant landmine location. Propelled strategies are gone before by basic preprocessing methods, which are helpful for signal amendment and commotion decrease. Foundation subtraction methods dependent on multilayer demonstrating, spatial separating and versatile foundation subtraction are executed. In addition to that, de-correlation and balance sifting strategies are additionally examined. In the related choice combination system, nearby choices are transmitted to the combination focus to figure a worldwide choice. For this situation, the idea of certainty data of nearby choices is critical to acquire worthy discovery results. The Bahadur-Lazarsfeld and Chow developments are utilized to evaluate the joint likelihood thickness capacity of the connected choices. Besides, a choice combination dependent on fluffy set is executed. All proposed techniques are assessed utilizing recreated just as genuine GPR information estimations of numerous situations.

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DIGITAL SIGNAL PROCESSING TECHNIQUE FOR RECOGNITION OF DUAL TONE MULTI-FREQUENCY SIGNALING

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Abstract : Digital signal processing techniques for obtaining high accuracy in recognition of dual-tone multi-frequency signaling(DTMF) tones produced by the push buttons of the keypad of a traditional analog telephone which was a major consequence these days. In order to avoid that, the proposed methodologies employ a suitable computations to analyze one selected frequency component from a discrete signal[2][3]. A complete meteorological characterization of the methods, in terms of systematic and random errors, is achieved, demonstrating the high overall performance.

Keywords: DTMF, FFT, discrete signal, DFT, digital filter.

I INTRODUCTION

Digital signal processing (DSP) is the use of digital processing, such as by computers or more specialized digital signal processors, to perform a wide variety of signal processing operations. The signals processed in this manner are a sequence of numbers that represent samples of a continuous variable in a domain such as time, space, or frequency. Digital signal processing and analog signal processing are subfields of signal processing. DSP applications include audio and speech processing, sonar, radar and other sensor array processing, spectral density estimation, statistical signal processing, digital image processing, signal processing for telecommunications, control systems, biomedical engineering, seismology, among others.DSP can involve linear or nonlinear operations. Nonlinear signal processing is closely related to nonlinear system identification [1] and can be implemented in the time, frequency, and spatio-temporal domains. The application of digital computation to signal processing allows for many advantages over analog processing in many applications, such as error detection and correction in transmission as well as data compression.[2] DSP is applicable to both streaming data and static (stored) data.

To digitally analyze and manipulate an analog signal, it must be digitized with an analog-to-digital converter (ADC).[3] Sampling is usually carried out in two stages, discretization and quantization. Discretization means that the signal is divided into equal intervals of time, and each interval is represented by a single measurement of amplitude. Quantization means each amplitude measurement is approximated by a value from a finite set. Rounding real numbers to integers is an example. The Nyquist–Shannon sampling theorem states that a signal can be exactly reconstructed from its samples if the sampling frequency is greater than twice the highest frequency component in the signal. In practice, the sampling frequency is often significantly higher than twice the Nyquist frequency.[4].Theoretical DSP analyses and derivations are typically performed on discrete-time signal models with no amplitude inaccuracies (quantization error), "created" by the abstract process of sampling. Numerical methods require a quantized signal, such as those produced by an ADC. The processed result might be a frequency spectrum or a set of statistics. But often it is another quantized signal that is converted back to analog form by a digital-to-analog converter (DAC).

In DSP, engineers usually study digital signals in one of the following domains: time domain (one-dimensional signals), spatial domain (multidimensional signals), frequency domain, and wavelet domains. They choose the domain in which to process a signal by making an informed assumption (or by trying different possibilities) as to which domain best represents the essential characteristics of the signal and the processing to be applied to it. A sequence of samples from a measuring device produces a temporal or spatial domain representation, whereas a discrete Fourier transform produces the frequency domain representation.

DSP algorithms may be run on general-purpose computers and digital signal processors. DSP algorithms are also implemented on purpose-built hardware such as application-specific integrated circuit (ASICs). Additional technologies for digital signal processing include more powerful general purpose microprocessors, field-programmable gate arrays (FPGAs), digital signal controllers (mostly for industrial applications such as motor control), and stream processors.[6]For systems

AN EFFECTIVE MECHANISM FOR MEASURING CARDIAC WITH DIGITAL IMAGE PROCESSING

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Abstract : Estimation of cardiovascular constriction speed utilizing M-mode ultrasonography with the assistance of computerized image handling has been done. Investigation of organ development rate is critical in therapeutic imaging as it identifies with conclusion for infections. This exploration is planned for estimating the pace of heart constriction utilizing advanced image preparing that utilizes the dynamic form division strategy. The example utilized is a video of heart check utilizing M-mode USG that keeps going 30 seconds and has a casing pace of 30 edges/seconds. This image was then removed as to get 900 USG images each at 480 x 360 pixels. Estimation of the edges of heart images was led utilizing MATLAB programming. Results demonstrate that the cardiovascular in the video moved most remote at 73/30 seconds, to 10.34 mm against the x-hub and at 28/30 seconds, to 14.00 mm from the y-hub. Then, the constriction speed changed. Introductory focus concentrated on the utilization of entropy in surface investigation to relate a tendon's appearance in a ultrasound image to its mechanical trustworthiness. Bewildering impacts, for example, movement curios and locale of intrigue choice by the client constrained the pertinence of little areas chose for examination, however broad patterns were watched at the point when the whole imagined tendon or shallow foundation district was chosen. Entropy computations recommended a noteworthy change in surface example for tedious locales contrasted with the chose foundation areas.

Keywords : Velocity,Cardiac,USG Image,Digital Image Processing

I INTRODUCTION

Examination of organ development speed is vital in medicinal imaging as it identifies with analysis for ailments. Moves moving speed can likewise be utilized to pack computerized images utilizing squares dependent on movement estimation methods [7]. Estimating organs' movement speed is important so as to know the situation of specific organs at specific occasions, as this likewise identifies with the correct treatment the organs may require [17]. In the course of recent years there have been studies concerning examinations of organ movement speed. Organ movement estimation is utilized in the examination of bosom distortion to know tissue versatility and give signs to tissue firmness by ascertaining the images' relative strain and youthful modulus [10]. Some flexibility imaging systems have likewise been created to quantitatively quantify tissue versatility with the assistance of ultrasound. Models for these incorporate location and analysis of malignant growth in bosom, prostate, and liver.Different models incorporate related clinical applications that measure the flexible property of delicate tissues. Subsequently, the improvement of elastography USG occurred. This method demonstrates extraordinary guarantee because of its continuous capacity and its usability. Restorative ultrasound is a methodology that is usually utilized in a wide assortment of applications because of various advantages it offers: it is non-intrusive, non-ionizing, modest, and has incredible transient resolution. It depends on utilization of high frequency acoustics to a volume of enthusiasm for heartbeats and

DEEP LEARNING FRAMEWORK FOR SIGNAL DETECTION AND MODULATION RECOGNITION

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Abstract

Deep learning is an efficient technique which has achieved a great success in wide variety of applications. In this paper research is done on multi-signals detection and modulation classification which are used in many communication systems. In this paper an efficient DL framework for multi-signals detection and modulation recognition is proposed. Signal modulation format, center frequency, and start-stop time can be obtained from the proposed method. Further in our research paper two networks are built:(1)Single shot multi-box detector(SSD) for signal detection and (2)Multi inputs convolutional neural networks(CNNs) for modulation recognition.

Keywords : deep learning; signal detection; modulation classification; the single shot multi-box detector networks; the multi-inputs convolutional neural networks

I INTRODUCTION

Deep learning is a piece of a more extensive group of AI strategies dependent on counterfeit neural systems with portrayal learning.Deep learning structures, for example, profound neural systems, profound conviction systems, repetitive neural systems and convolutional neural systems have been applied to fields including PC vision, discourse acknowledgment, normal language handling, sound acknowledgment, informal community sifting, machine interpretation, bioinformatics, tranquilize plan, clinical picture examination, material investigation and pre-packaged game projects, where they have delivered results tantamount to and now and again outperforming human master execution. Artificial Neural Networks (ANNs) were motivated by data handling and dispersed correspondence hubs in natural frameworks. ANNs have different contrasts from natural cerebrums. In particular, neural systems will in general be static and representative, while the natural mind of most living beings is dynamic (plastic) and simple.By using Deep learning predictive models effective signal detection and modulation recognition techniques have been implemented.

Cognitive radio (CR) [1–3] has been utilized to allude to radio gadgets that are equipped for learning and adjusting to their condition. Because of the expanding prerequisites for remote transfer speed of radio range, programmed signal detection and modulation recognition strategies are essential. It can help clients to recognize the tweak configuration and gauge signal parameters inside working groups, which will profit correspondence reconfiguration and electromagnetic condition investigation. Moreover, it is generally utilized in both military and regular citizen applications, which have pulled in a lot of consideration in the past decades [4–7]. Multi-signals location is an errand to distinguish the current signals in a particular wideband, which is one of the basic segments of CR. The most critical difference among signal and non-signal is vitality. Consequently, numerous wideband multi-signals identification calculations depend on Energy Detector (ED). Some limit based wideband sign discovery techniques, for example, [8–13], lessen the likelihood of

AN ENHANCED METHODOLOGY FOR TAMPER DETECTION IN IMAGE FORGERY

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Abstract: The sharing of advanced pictures has become a typical practice in our day by day life, with the hazard that these pictures can be gotten to and effortlessly changed by malevolent individuals with the goal of causing good or monetary harm; or even to implicate guiltless individuals in legitimate issues. This paper proposes a calculation to validate computerized pictures by methods for daze altering identification against one of the chief controls that a picture is gotten through, for example the Copy-Move which expects to delete or imitate a piece of the picture. The advancement and assessment consequences of this proposition are introduced right now.

Keywords : Discrete Fourier Transform,SURF,MSER,Tamper detection.

I INTRODUCTION

These days, a tremendous measure of computerized pictures, with or without business esteem, are effectively shared among the overall population by means of Internet or put away utilizing any of the few accessible advanced organizations. Such pictures, which incorporate private pictures or secret pictures, have by and large high caliber and can be handily controlled utilizing computational apparatuses, for example, Photoshop®, Corel Paint Shop®, and so on. Such sort of noxious assaults can be isolated in duplicate move and reorder assaults. The duplicate move is one of the most considered fraud methods which comprise in replicating a segment of a subjective size and state of a given picture and gluing it in another area of a similar picture. Obviously, this system is valuable when the falsifier needs either to cover up or copy something that is as of now present in the first picture [1][2]. Then again, in the reorder assault or joining, the aggressor right off the bat picks an area of a given picture and glues it into a subsequent one, for the most part to modify its substance and importance. Joining is likely more typical than the duplicate move assault, since it is undeniably increasingly adaptable and permits the making of pictures with a totally different substance regarding the first picture [2].The picture verification has been a subject of dynamic research during the most recent quite a while, in light of the fact that the altered pictures may make good or monetary harms the people identified with the noxiously adjusted pictures, giving subsequently the production of a few picture confirmation procedures, which can be comprehensively grouped into two kinds: dynamic and uninvolved picture validation strategies. The principle distinction among them is that in the dynamic techniques some helpful data is extricated from the picture to be verified and implanted in it or put away independently. This data is then utilized during the confirmation procedure. Then again, in the detached strategies, additionally called measurable techniques, the validation must be completed without past data about the handling that the picture to be confirmed had gone through [1][2]. The dynamic techniques can be arranged into two classifications: the watermarking-based and the picture hashing-based plans, them two with

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Boosting ON-Current in Tunnel FETs (TFETs): A Review

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***Abstract*—In this paper, a review of various techniques implemented to boost the ON-state current in a TFET is presented. The current conduction in a TFET happens due to band-to-band-tunneling (BTBT) taking place through the tunneling junction formed between the source and the channel regions. Thus, controlling the tunneling junction is the key in a TFET for generation of sufficient ON-current. In each case, the technique implemented to control the tunneling junction so as to reduce the height and width of the tunneling barrier is discussed. Further, ON state current, OFF state current, ON-to-OFF current ratio, sub-threshold slope (SS) and the modeling method is discussed. At the end, based on the review, proposal is made for the possible future course of actions to boost the ON-current, suppress the OFF-current and improve the ON-to-OFF current ratio in TFETs.**

Keywords—Tunneling, BTBT, source pocket, high-k dielectric, sub-threshold swing, ON-state & OFF-state currents, vertical tunneling, hetero dielectric BOX.

I. INTRODUCTION

Due to an increasing consumer demand for low power electronic appliances ranging from computing, communication and entertainment to automotive, navigation and other hand held and portable applications there has been unprecedented research [1,2] in the recent past on developing low power transistors. Till recently, CMOS was the only choice for its power and noise performance. But as the consumer demand for compute intensive devices are growing, more and more transistors are being integrated in lesser silicon core area leading to an increase in power consumption.MOSFETs are scaled down to achieve higher packing density along with reduced power consumption. However, the sub-threshold swing (SS) which is a measure of the gate voltage necessary to change the drain current by one order of magnitude, can't be scaled. As a result, it becomes difficult to turn ON and OFF the device at low supply voltages. In order to establish a scenario where sufficient ON-current is achieved with an insignificant OFF-state leakage,curbing of SS is essential.But the prevailing research so far shows that it has become a critical barrier in the journey towards achieving a low power ecosystem of electronics.

Tunneling FET (TFET) has emerged as the most promisingswitching element operating at very low voltage overcoming the 60mV/dec switching limit while physically being perfectly compatible with the dominant CMOS materials and processing[3]. TFETs have a different carrier transport mechanism namely quantum tunneling in contrast to thermionic emission in MOSFETs.TFETs have got an edge over traditional MOSFETs in several aspects such as it operates at low voltage, produces an insignificant leakage current and more importantly SS is less than the physical limit of MOSFET (60 mV/dec). These are its key features that are favorable for low power applications [4,5]. However, it suffers from low ON state current (I_{on}). The I_{on} of TFET is lower than the ITRS limits. High I_{on} is required in design of high speed VLSI circuits to enable high fan-out, reduced delay & increased clock frequencies.

In order to overcome the precarious problem of low ON-state current in TFET, several techniques have been proposed which are related to gate engineering, tunneling junction engineering, material engineering, hetero junctions and modification related to the structure of the TFET.

Out of all the methods of boosting I_{on} mentioned above, tunneling junction engineering stands as the most important mechanism as it is the tunneling junction which controls the overall current generated due to BTBT.

The condition for the tunneling to occur is that the filled and empty states are separated by a narrow potential barrier of finite height [6]. Thus when the empty states in the source valence band and filled states in the channel conduction band are energetically aligned, tunneling occurs. Moreover, it is the width and height of the tunneling barrier which decides the overall ON-current. Smalleris the width and heightof the barrier more will be the drain current.

II. DRAIN CURRENT IN TFET

The drain current I_{DS} is obtained by integrating the band-to-bandtunneling generation rate over the volume of the tunneling region [7],

$$I_{DS} = \iint G \,.dx.dy \tag{1}$$

Where G is the tunneling generation rate defined as the number of carriers per unit volume per unit time, given by Kane's model [8] as,

$$G(E) = A \cdot \frac{|E|^2}{\sqrt{E_g}} \cdot e^{\left[-B\frac{E_g^{\frac{3}{2}}}{|E|}\right]} \tag{2}$$

Where $|E|$ is the magnitude of the electric field defined as $|E| = \sqrt{E_x{}^2 + E_y{}^2}$ where E_x and E_y are the lateral and vertical electrical fields, E_g is the energy band-gap. A & B are constants and are called tunneling parameters [9].

The eq.(1) suggests that the drain current is dependent upon the tunneling generation rate which is a function of the electric field (E) and the band-gap (E_g). The total electric field constitutes the vertical electric field caused by V_{gs} and lateral electric field caused by V_{ds}. Out of both of these fields, lateral electric field plays a significant role in the drain current analysis because the maximum BTBT occurs along this axis, which is shown in Fig.1.[10]. Fig.1 shows the Energy band diagram of a TFET for both ON and OFF states.

CERTAIN PARTITION THEOERMS

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Abstract: **In this paper, we have taken certain partition theorem due to Slater'5; and making use of known identities to establish some new partition theorems in original research work.**

Key words: **Generalized hyper geometric function and Gauss hyper geometric function and Ordinary hyper-geometric series; identities, known transformation formulae.**

2010AMS Subject Classification: 11P82, 11P83 and 11P84.

1. *Introduction:*

In this paper , an attempt has been made to established certain partition theorems similar to Roger's – Ramanujan theorems by adapting the pattern of Hirechorn [1], Subbraao and Agrawal [1] and Singh, S.N. [3],. We consider the following identities due to Slate [5];

$$\sum_{n=0}^{\infty} \frac{q^{2n^2}}{(q;q)_{2n}} = \frac{1}{(q^2,q^3,q^4,q^5,q^{11},q^{12},q^{13},q^{14};q^{16})_\infty} \quad (1)$$

$$[Slater^5; (83)P.160]$$

$$\sum_{n=0}^{\infty} \frac{q^{2n^2}}{(q;q)_{2n}} = \frac{1}{(q,q^3,q^4,q^5q^7,q^9,q^{11},q^{12},q^{13},q^{15},q^{16},q^{17},q^{19};q^{20})_\infty} \quad (2)$$

$$[Slater^5; (79)P.160]$$

$$\sum_{n=0}^{\infty} \frac{q^{2(2n+1)}}{(q;q)_{2n+1}} = \frac{1}{(q,q^3,q^5,q^7,q^9,q^{11},q^{13},q^{15};q^{16})_\infty} \quad (3)$$

$$[Slater^5; (84)P.161]$$

$$\sum_{n=0}^{\infty} \frac{q^{2(2n-1)}}{(q;q)_{2n}} = \frac{1}{(q,q^3,q^5,q^7,q^9,q^{11},q^{13},q^{15};q^{16})_\infty} \quad (4)$$

$$[Slater^5; (85)P.161]$$

$$\sum_{n=0}^{\infty} \frac{q^{2(2n+1)}}{(q;q)_{2n+1}} = \frac{1}{(q,q^4,q^6,q^7,q^9,q^{10},q^{12},q^{15};q^{16})_\infty} \quad (5)$$

$$[Slater^5; (86)P.161]$$

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On Lambert series and continued fractions

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Abstract: In this paper, we have established certain results involving Lambert series and continued fractions.

Keywords and Phrases: Lambert series, continued fractions, q-shifted factorial, basic hypergeometric series.
Mathematics Subject Classification: 33D15, 11B65.

1. Introduction, Notations and Definitions

The q-shifted factorial is defined by,

$$(a,q)_n = \begin{cases} 0 & \text{if } n=0; \\ (1-a)(1-aq)(1-aq^2)\ldots,(1-aq^{n-1}) & \text{if } n \geq 1. \end{cases}$$

Also,

$$(a;q)_{-n} = \frac{q^{n(n+1)/2}}{(-a)^n (q/a;q)_n}.$$

The generalized basic hypergeometric series is given by

$${}_{r+1}\Phi_r \left[\begin{matrix} a_1, a_2, ..., a_{r+1}; q; z \\ b_1, b_2, ..., b_r \end{matrix} \right] = \sum_{n=0}^{\infty} \frac{(a_1, a_2, ..., a_{r+1}; q)_n z^n}{(q, b_1, b_2, ..., b_r; q)_n},$$

where $(a_1, a_2, ..., a_{r+1}; q)_n = (a_1;q)_n (a_2;q)_n ... (a_{r+1};q)_n$ and $\max.(|z|, |q|) < 1$ for the convergence of the series.

The generalised bilateral basic hypergeometric series is defined as,

$${}_{r}\Psi_r \left[\begin{matrix} a_1, a_2, ..., a_r; q; z \\ b_1, b_2, ..., b_r \end{matrix} \right] = \sum_{n=-\infty}^{\infty} \frac{(a_1, a_2, ..., a_r; q)_n z^n}{(b_1, b_2, ..., b_r; q)_n},$$

where $\left| \frac{b_1, b_2, ..., b_r}{a_1, a_2, ..., a_r} \right| < |z| < 1$ for the convergence of the series.

An expression of the form,

$$b_0 + \frac{a_1}{b_1 +} \frac{a_2}{b_2 +} \frac{a_3}{b_3 + ...}$$

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ON CERTAIN TRANSFORMATION FORMULAS INVOLVING q-HYPERGEOMETRIC SERIES

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Dedicated to Prof. K. Srinivasa Rao on his 75^{th} Birth Anniversary

Abstract: In this paper transformations formulas involving q-hypergeometric series have been established. Certain identities have been deduced as special cases.

Keywords and Phrases: q-hypergeometric series, transformation formula, summation formula, identity.

2010 Mathematics Subject Classification: 33D15, 11B65.

1. Introduction, Notations and Definitions

Throughout the paper, we use the customary notation,

$(a;q)_0 = 1$

$(a;q)_n = \prod_{r=0}^{n-1}(1-aq^r), \quad n \geq 1,$

$(a;q)_\infty = \lim_{n\to\infty}(a;q)_n, \quad |q|<1$

and

$(a_1, a_2, a_3, ..., a_r; q)_n = (a_1;q)_n(a_2;q)_n(a_3;q)_n...(a_r;q)_n,$

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TRANSFORMATION FORMULAE INVOLVING PARTIAL MOCK THETA FUNCTIONS

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Abstract: In this paper certain transformation formulae involving partial mock theta functions have been established.

Keywords and Phrases: Mock theta function, partial mock theta function, transformation formula.

2000 AMS Subject Classification: 33A30, 33D15.

1. Introduction Notations and Definitions

Early in 1920, three months before his death, Ramanujan wrote his last letter to Professor G.H. Hardy. In the course of it he said: "I discovered very interesting functions recently which I call 'Mock' theta functions. Unlike the 'False' theta functions they enter into mathematics as beautifully as the ordinary theta functions. I am sending you with this letter some examples."

The first three pages in which Ramanujan explained what he meant by a "Mock-theta function" are very obscure. They will be made clearer by Hardy's comment that a Mock theta-function is a function defined by a q-series, convergent when $|q| < 1$, for which we can calculate asymptotic formula when q-tends to a rational point $e^{2\pi ir/s}$ of the unit circle, of the same degree of precision as these furnished for the ordinary theta functions by the theory of linear transformation. The last pages of Ramanujan's notes consist of lists of definitions of four sets of Mock functions with statements of relations connecting members of each of the first s; for fairly obvious reasons the functions in the various sets.

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ON CERTAIN DOUBLE SERIES IDENTITIES

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Abstract: In this paper, making use of Bailey transform and WP-Bailey transform, certain double series identities of Rogers-Ramanujan type have been established.

Keywords and Phrases: Bailey pair, WP-Bailey pair, identities, double series identities.

Mathematics Subject Classification: Primary 33D15, 33D90, 11A55, Secondary 11F20, 33F05.

1. Introduction, Notations and Definitions

In the present paper, we adopt the following notations and definitions. The q-rising factorial is defined by, for $|q| < 1$.

$$(a;q)_n = (1-a)(1-aq)...(1-aq^{n-1}), \quad n = 1, 2, 3, ...$$

$$(a;q)_0 = 1$$

$$(a;q)_\infty = \prod_{r=0}^{\infty}(1-aq^r)$$

and

$$(a_1, a_2, ..., a_r; q)_n = (a_1;q)_n(a_2;q)_n...(a_r;q)_n.$$

With theses notations, a basic hypergeometric series (q-series) is defined by,

$${}_r\Phi_s\left[\begin{matrix} a_1, a_2, ..., a_r; q; z \\ b_1, b_2, ..., b_s \end{matrix}\right] = \sum_{n=0}^{\infty} \frac{(a_1, a_2, ..., a_r; q)_n z^n}{(q, b_1, b_2, ..., b_s; q)_n} \left\{(-1)^n q^{n(n-1)/2}\right\}.$$

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A NOTE ON THETA HYPERGEOMETRIC SERIES

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ıct: In this article, making use of Bailey transform and certain known es, we have established certain transformation formulas for elliptic hyper-ric series

ırds: Bailey transform, elliptic hypergeometric series, identities, transformula.

Iathematics Subject Classification: 33D15, 33E05.

oduction, Notations and Definitions

path-breaking paper, Frankel and Turaev [1] introduced elliptic analogues well-poised basic hypergeometric series. Elliptic hypergeometric series and tensions to theta hypergeometric series has become an increasingly active research now these days. So for, many formulae for very well-poised ba-rgeometric series have already been extended to the elliptic setting. Some for multi-basic elliptic hypergeometric series appeared in the work of War-In this paper, using certain identities we have established transformation

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On certain transformation formulae for terminating hypergeometric series

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Abstract: In this paper, making use of Bailey's Lemma and certain known summation formulae an attempt will be made to establish transformations involving terminating basic hypergeometric series. We shall deduce the transformations involving terminating and truncated series from our results

Keywords and phrases: Terminating basic hypergeometric function/series, Bailey's Lemma, truncated series and summation formula.

2000 AMS subject classification: 33A30, 33D15, 11B65, 05A30.

1. Introduction, Notation and Definition

Throughout this paper we shall adopt the following notation and definition; For any numbers a and q, real or complex and $|q| < 1$, let

$$[\alpha;q]_n \equiv [\alpha]_n = \begin{cases} (1-\alpha)(1-\alpha q)(1-\alpha q^2)...(1-\alpha q^{n-1}); & n>0 \\ 1 \qquad\qquad\qquad\qquad\qquad\qquad\quad ; & n=0 \end{cases} \tag{1.1}$$

Accordingly, we have

$$[\alpha;q]_\infty = \prod_{n=0}^{\infty}(1-\alpha q^n)$$

REDUCTION OF DOUBLE HYPERGEOMETRIC SERIES

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Abstract: In this paperwork, we have taken certain transformation formulae due to Slater [2]; App. (III) Verma & Jain [1] and making use of known identities, to establish some double hyper geometric series into single series.

Key words: Generalized hyper - geometric function / Gauss hyper - geometric function and Ordinary hyper-geometric series; identities, known transformation formulae.

2010AMS Subject Classification: 33C20.

1. Introduction, Notation and Definitions

We shall make use of the following well known identities:

$$\sum_{n=0}^{n=\infty} \sum_{k=0}^{n} B(n,k) = \sum_{n=0}^{n=\infty} \sum_{k=0}^{\infty} B(k, n+k), \qquad (1.1)$$

An explicit representation of generalized hyper geometric functions

$$r^{F_S}\left[\begin{matrix} a_1, & a_2, & \dots, & a_r; \\ b_1, & b_2, & \dots, & b_s \end{matrix} \; z\right] = r^{F_S}\left[\begin{matrix} (a)_r; \\ (b)_s \end{matrix} \; z\right] = \sum_{n=0}^{\infty} \frac{[(a_r)]_n \; z^n}{[1]_n \; [(b_s)]_n}, \qquad (1.2)$$

Valid for $|z| < 1$, provided no zeros appear in denominator. Here $a_1, a_2, a_3, \cdots, a_r$ and $b_1, b_2, b_3, \cdots, b_s$ and z are assumed to be complex number.

The shifted factorial is defined by

$$(a)_n = \begin{Bmatrix} 1, & n = 0 \\ a(a+1) \dots\dots\dots\dots\dots\dots (a+n+1); & n > 0 \end{Bmatrix} \qquad (1.3)$$

In order to establish the reducibility of double hyper-geometric series into single series, we shall be need of the following known summation formulae due to (Slater [2], App.III) and Verma & Jain [1] in our analysis:

$$3^{F_2}\left[\begin{matrix} -n, & -n-x, & y; \\ 1+x, & -n-y & \end{matrix} \; 1\right] = \frac{(1)_n \, (1+x-y)_m (1+y)_m}{(1+x)_m \, (1+y)_n (1)_m}, \qquad (1.4)$$

where m is greatest integer $\leq \frac{n}{2}$.

[Verma & Jain [1]; (2.7) P. 1024]

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A NOTE ON THETA HYPERGEOMETRIC SERIES

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Abstract: In this article, making use of Bailey transform and certain known identities, we have established certain transformation formulas for elliptic hypergeometric series

Keywords: Bailey transform, elliptic hypergeometric series, identities, transformation formula.

2010 Mathematics Subject Classification: 33D15, 33E05.

1. Introduction, Notations and Definitions

In a path-breaking paper, Frankel and Turaev [1] introduced elliptic analogues of very well-poised basic hypergeometric series. Elliptic hypergeometric series and their extensions to theta hypergeometric series has become an increasingly active area of research now these days. So for, many formulae for very well-poised basic hypergeometric series have already been extended to the elliptic setting. Some formulae for multi-basic elliptic hypergeometric series appeared in the work of Warnaar [7]. In this paper, using certain identities we have established transformation

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APPLICATION OF CONJUGATE BAILEY PAIR AND CONJUGATE WP-BAILEY PAIR TO ESTABLISH SUMMATIONS AND q- SERIES IDENTITIES

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Abstract: In this paper, making use of Bailey pair, conjugate Bailey pair, WP-Bailey pair and conjugate WP-Bailey pair, four theorems have been established which yield certain double series identities as special cases.

Keywords and Phrases: Bailey pair, WP-Bailey pair, conjugate Bailey pair, conjugate WP-Bailey pair, summation formula and identities.

2010 Mathematics Subject Classification: Primary 11A55, 33D15, 33D90; Secondary 11F20, 33F05.

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BASIC ANALOGUE OF STIELTJES TRANSFORM AND ITS PROPERTIES

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Abstract: In this paper, basic analogue of Stieltjes transform has been established. Properties of basic Stieltjes transform have been also discussed.

Keywords and Phrases: Stieltjes transform, Gauss's hypergeometric series, basic hypergeometric series, ordinary binomial theorem, basic binomial theorem.

2020 Mathematics Subject Classification: 44A10, 47D03.

1. Introduction, Notations and Definitions

Gaussian hypergeometric series is defined as,

$$ {}_2F_1\left[a,b;c;z\right] = \sum_{n=0}^{\infty} \frac{(a)_n (b)_n z^n}{(c)_n n!}, \tag{1.1} $$

where $(a)_n = a(a+1)...(a+n-1) = \dfrac{\Gamma(a+n)}{\Gamma(a)}$, and $(a)_0 = 1$.
For the convergence of the series (1.1), $|z| < 1$ is needed.

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On Certain Transformation Formulae for Hypergeometric Series

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ABSTRACT

In this paper, making use of Bailey's Lemma and certain known summation formulae due to Slater [2], Verma & Jain an attempt will be made to establish new interesting transformation formulae for hyper-geometric series.

Key words: Ordinary and basic hyper-geometric function / series, Bailey's Lemma, summation formulae.

2010AMS Subject Classification: 33C20.

1. Introduction, Notations and Definitions:

The transform which was discovered by Bailey [1] in 1947.

If

$$\beta_n = \sum_{r=0}^{n} u_{n-r}\, v_{n-r}\, \alpha_r \qquad (1.1)$$

And

$$\gamma_n = \sum_{r=n}^{\infty} u_{n+r}\, v_{n-r}\delta_n = \sum_{r=0}^{\infty} u_r\, v_{r+2n}\delta_{r+n} \qquad (1.2)$$

then, under suitable convergence conditions ,

$$\sum_{r=0}^{\infty} \alpha_n\gamma_n = \sum_{n=0}^{\infty} \beta_n\, \delta_n \qquad (1.3)$$

where α_n, δ_n, u_r ***and*** v_r ***are any functions*** r ***only*** **,such that the series γ_n exists, making use of (1.3), Bailey was developed a technique to obtain various transformation formulae for ordinary and q- series , which play an important role in number theory and hyper geometric series. Singh [2] be obtained many transformation formulae for q- series by using Bailey's transformation and certain known result due to Slater [2] and Verma & Jain [1]. In this paper, an attempt we have been made to establish certain transformation formulae for hyper geometric series by using Bailey transformation and some known formulae from Verma & Jain [1].**

An explicit representation of generalized hyper geometric functions

$$r^{F_S}\left[\begin{matrix} a_1, & a_2, \ldots, & a_r; & z \\ b_1, & b_2, \ldots, & b_s & \end{matrix}\right] = r^{F_S}\left[\begin{matrix} (a)_r; & z \\ (b)_s & \end{matrix}\right] = \sum_{n=0}^{\infty} \frac{[(a_r)]_n\, z^n}{[1]_n\, [(b_s)]_n}. \qquad (1.4)$$

$$valid\ for\ |z| < 1, provided\ no\ zeros\ appear\ in\ denominator.$$

Here $a_1, a_2, a_3, \cdots, a_r$ and $b_1, b_2, b_3, \cdots, b_s$ and z are assumed to be complex number.

The shifted factorial is defined by

$$(a)_n = \begin{cases} 1, & n = 0 \\ a(a+1)\ldots\ldots\ldots\ldots\ldots (a+n+1); & n > 0 \end{cases} \qquad (1.5)$$

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We shall use be the following known summation formulae due to (Slater [2], App. III) and Verma & Jain [1] to establish many transformation.

$$3F_2\left[\begin{matrix} a, & b, & -n; & 1 \\ & 1+a-b, & 1+a+n & \end{matrix}\right] = \frac{(1+a)_n\,(1+\frac{1}{2}a-b)}{(1+a)_n\,(1+a-b)_n}, \qquad (1.6)$$

[Slater [2]; App.III (III.9)]

$$4F_3\left[\begin{matrix} a, & 1+\frac{1}{2}a, & b, & -n; & 1 \\ & \frac{1}{2}a, & 1+a-b, & 1+a+n & \end{matrix}\right] = \frac{(1+a)_n}{(1+a-b)_n}. \qquad (1.7)$$

[Slater [2]; App. III (III.II)]

$$3F_2\left[\begin{matrix} a, & b, & -n; & 1 \\ & 1+a-b, & 1+2b-n & \end{matrix}\right] = \frac{(a-2b)_n\,(1+\frac{1}{2}a-b)_n\,(-b)_n}{1+a-b)_n\,(\frac{1}{2}a-b)_n\,(-2b)_n}. \qquad (1.8)$$

[Slater [2]; App. III (III.16)]

$$3F_2\left[\begin{matrix} x, & 3x+y+n, & -n; & \frac{3}{4} \\ & \frac{3}{2}(x+1), & \frac{3}{2}(x+2) & \end{matrix}\right] = \frac{(1)_n\,(2x+4)_n\,(x+2)_n\,(x+3)_{3m}}{(1)_n(1+x)_n\,(3x+4)_n(2x+4)_{3m}}. \qquad (1.9)$$

$$provided\ that\ m\ is\ the\ greatest\ integer \leq \frac{n}{3}.$$

[Verma & Jain [1]; (1.5) P. 1022]

$$3F_2\left[\begin{matrix} -n & 1+n+2x+2y, & x; & 1 \\ & 1+x+y, & 1+2x & \end{matrix}\right] = \frac{(1)_n\,(1+x)_m(1+y)_m}{(1)_m\,(1+2x)_n\,(1+x+y)_m}. \qquad (1.10)$$

$$where\ m\ is\ the\ greatest\ integer \leq \frac{n}{2}.$$

[Verma & Jain [1]; (2.26) p.1028]

$$4F_3\left[\begin{matrix} \frac{a}{3}, & 1+\frac{a}{2}, & 1+a+n, & -n; & \frac{3}{4} \\ & \frac{a}{2}, & \frac{1}{2}+\frac{a}{2}, & 2+\frac{a}{2} & \end{matrix}\right] = \frac{(1)_n\,(\frac{a}{2})_n\,(1+\frac{a}{2})_m\,(2+\frac{a}{6})_m}{(1+a)_n\,(2+\frac{a}{2})_n\,(\frac{a}{6})_m\,(1)_m}. \qquad (1.11)$$

$$where\ m\ is\ the\ greatest\ integer \leq \frac{n}{2}.$$

[Verma & Jain [4]; (4.9) p. 1037]

2. Main Results:

In this Section, we shall establish the following results.

2.1 Taking: $u_n = \frac{1}{(1)_n}, v_n = \frac{1}{(1+a)_n}$ *and* $\alpha_n = \frac{1}{n!\,(1+\frac{1}{2a})_n\,(1+a-b)_n}$

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$and\ \delta_r = (\alpha)_n\ (\beta)_n\ in\ (1.1) and\ (1.2) and\ using\ (1.6), we\ have$:

$$\beta_n = \frac{(1+\frac{1}{2}a-b)}{n!\ (1+\frac{1}{2}a)_n\ (1+a-b)_n} \qquad (2.1.1)$$

$$and\ \gamma_n = \frac{\Gamma(1+a)\ \Gamma(1+a-\alpha-\beta)}{(\Gamma(1+a-\alpha)\Gamma(1+a-\beta)} \frac{(\alpha)_n\ (\beta)_n}{(1+a-\alpha)_n\ (1+a-b)_n} \qquad (2.1.2)$$

$$provided\ RL\ (1+a\ -\alpha-\beta) > 0.$$

Putting these values in (1.3), **we have:**

$$4^{F_3}\left[\begin{matrix} a, & b, & \alpha, & \beta; & 1 \\ 1+a-b, & 1+a-\alpha, & 1+a-\beta & & \end{matrix}\right] = \frac{\Gamma(1+a-\alpha)\ \Gamma(1+a-\beta)}{\Gamma(1+a)\ \Gamma(1+a-\alpha-\beta)} \times\ 3^{F_2}\left[\begin{matrix} \alpha, & \beta, & 1+a-b\,;1 \\ 1+\frac{1}{2}a, & 1+a-b & \end{matrix}\right].$$

(2.1.3)

$$provided\ RI\ (1+a-\alpha-\beta)\ > 0.$$

2.2 Taking:

$$u_n = \frac{1}{(1)_n},\ v_n = \frac{1}{(1+a)_n} \text{ and } \alpha_n = \frac{(a)_n\ (1+\frac{1}{2}a)_n\ (b)_n}{n!\ (\frac{1}{2}a)_n\ (1+a-b)_n}$$

$and\ \delta_n = (\alpha)_n\ (\beta)_n\ in\ (1.1)\ and\ (1.2)\ and\ using\ (1.7)\ , we\ have$:

$$\beta_n = \frac{1}{n!\ (1+a-b)_n} \qquad (2.2.1)$$

$$and\ \gamma_n = \frac{(\alpha)_n\ (\beta)_n}{(1+a-\alpha)_n\ (1+a-\beta)_n} \frac{\Gamma(1+a)\ \Gamma(1+a-\alpha-\beta)}{\Gamma(1+a-\alpha)\ \Gamma(1+a-\beta)}, \qquad (2.2.2)$$

$$provided\ RI\ (1-a-\ \alpha-\beta) > 0.$$

Now, putting these values in (1.3), we get:

$$5^{F_4}\left[\begin{matrix} a, & 1+\frac{1}{2}a, & b, & \alpha, & \beta; & 1 \\ \frac{1}{2}a, & 1+a-b, & 1+a-\alpha, & 1+a-\beta & & \end{matrix}\right]$$

$$= \frac{\Gamma 1+a-\alpha\ \Gamma 1+a-\beta}{\Gamma 1+a\ \Gamma 1+a-\alpha-\beta} \times \frac{\Gamma 1+a-b\ \Gamma 1+a-b-\alpha-\beta}{\Gamma 1+a-b-\alpha\ \Gamma 1+a-b-\beta}, \qquad (2.2.3)$$

$$provided\ RL\ (1+a-\alpha-\beta) > 0.$$ **2.3 Setting:**

$$u_n = \frac{(-2b)_n}{(1)_n}\ ,\ v_n = 1 \text{ and } \alpha_n = \frac{(a)_n\ (b)_n}{n!\ (1+a-b)_n}$$

$and\ \delta_n = z^n$ **in (1.1) and (1.2) and using (1.8), we have:**

$$\beta_n = \frac{(a-2b)_n\ (1+\frac{1}{2}a-b)_n\ (-b)_n}{n!\ (1+a-b)_n\ (\frac{1}{2}a-b)_n} \qquad (2.3.1)$$

$$and\ \gamma_n = z^n\,(1-z)^{2b}. \qquad (2.3.2)$$

Now, putting these values in (1.3), we get:

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$$(1-z)^{2b}\ {}_2F_1[\ a,\ b;\ 1+a-b\ ;\ z] = {}_3F_2\left[\begin{matrix} a-2b\ , & 1+\frac{1}{2}a-b\ , & -b\ ; \\ & 1+a-b\ , & \frac{1}{2}a-b \end{matrix}\ \ z\right] \qquad (2.3.3)$$

2.4 Again setting:

$$u_n = 1 = v_n \quad \text{and} \quad \alpha_n = \frac{(a)_n\,(b)_n}{n!\,(1+a+b)_n}$$

$and\ \delta_n = z^n$, **in (1.1) and (1.2), and using (1.9), we have:**

$$\beta_n = \frac{(1+a)_n\,(1+b)_n}{n!\,(1+a+b)_n} \qquad (2.4.1)$$

$$and\ \gamma_n = \frac{z^n}{(1-z)} \qquad (2.4.2)$$

Now, putting these values in (1.3), we get:

$${}_2F_1[a\ ,\ b\ ;\ 1+a+b\ ;\ \ z] = (1\text{-}z)\ {}_2F_1[1+a\ ,\ 1+b\ ;\ \ 1+a+b\ ;\ \ z]\ . \qquad (2.4.3)$$

2.5 Further, setting:

$$u_n = \frac{1}{(1)_n}\frac{(1+y)_n}{(1+x)_n},\ v_n = 1\ and\ \alpha_n = \frac{(y)_n\,(-1)^n}{n!\,(1+x)_n}$$

$and\ \delta_n = (\alpha)_n\,(\beta)_n\ in\ (1.1)\ and\ (1.2)\ and\ using\ (1.9)$, *we have*:

$$\beta_n = \frac{(1+y)_m\,(1+x-y)_m}{(1+x)_n\,(1)_m\,(1+x)_m}, \qquad (2.5.1)$$

$$where\ m\ is\ the\ greatest\ integers \le \frac{n}{3}.$$

$$and\ \gamma_n = \frac{(1+y)_{2n}\ (\alpha)_n\ \Gamma(1+x)\Gamma(x-\alpha)(-1)^n}{(1+x-\alpha)_n\,(1-x+\alpha)_n\,\Gamma(1+x-\alpha)\Gamma(x-y)}, \qquad (2.5.2)$$

$$provided\ RL\ (x-\alpha-n) > 0.$$

Now, putting these values in (1.3), we get:

$$\sum_{n=0}^{\infty}\frac{(y)_n\,(1+x)_{2n}\,(\alpha)_n}{n!\,(1+x)_n\ (1+x-\alpha)_n\,(1-x+\alpha)_n} = \frac{\Gamma(1+x-\alpha)\Gamma(x-y)}{\Gamma(1+x)\Gamma(x-\alpha)}\sum_{n=0}^{\infty}\frac{(1+x-y)_n\,(1+y)_n\,(\alpha)_n}{(1+x)_n\,(1+x)_m\,(1)_m}, \qquad (2.5.3)$$

$$where\ m\ is\ the\ greatest\ integer \le 0.$$

2.6 Again, setting:

$$u_n = \frac{1}{(1)_n}\frac{(1+x)_n}{(1+2x)_n},\ v_n = 1\ \ and\ \alpha_n = \frac{(y)_n\,(-1)^n}{n!\,(1+2y)_n}$$

$and\ \delta_n = \alpha_n$, **in (1.1) and (1.2)and using (1.10), we get:**

$$\beta_n = \frac{(1+x)_m\,(1+y)_m\,(1+x+y)_n}{(1)_m\,(1+x+y)_m\,(1+2x)_n\,(1+2y)_n}, \qquad (2.6.1)$$

$$where\ m\ is\ the\ greatest\ integer \le \frac{n}{2}.$$

$$and\gamma_n = \frac{(\alpha)_n\,(\alpha-2x)_n\,\Gamma(x-a)\Gamma(1+2x)}{(1-x+2\alpha)_n\ \Gamma(x)\Gamma(1+2x-\alpha)}, \qquad (2.6.2)$$

$\boldsymbol{provided\ RL\ (x-\alpha-n)\ >0}$. **Now, putting these values in (1.3) we get:**

$$3^{F_2}\left[\begin{matrix} y, & \alpha-2x, & \alpha; & -1 \\ 2y+1, & 1-x-\alpha; & & \end{matrix}\right] = \frac{\Gamma(x)\Gamma(1+2x-\alpha)}{\Gamma(1+2x)\Gamma(x-\alpha)} \sum_{n=0}^{\infty} \frac{(\alpha)_n\,(1+x+y)_n\,(1+x)_m\,(1+y)_m}{(1+2x)_n\,(1+2y)_n\,(1+x+y)_m\,(1)_n}, \qquad \textbf{(2.6.3)}$$

$$\boldsymbol{where\ m\ is\ the\ greatest\ integer\ } \leq \frac{n}{2}.$$

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CERTAIN RESULTS INVOLVING q-HYPERGEOMETRIC SERIES AND RAMANUJAN'S MOCK THETA FUNCTIONS

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Abstract: In this paper certain transformation formulas for q-hypergeometric series have been established. In another section of this paper, results involving mock theta functions have also been established.

Keywords and Phrases: q-hypergeometric series, transformation formula, mock theta functions, truncated hypergeometric series, summation formula.

2020 Mathematics Subject Classification: 30G35, 32A30, 30C15.

1. Introduction, Notations and Definitions

The $q-$shifted factorial for $|q| < 1$ is defined as,

$$(a;q)_0 = 1$$