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INNOVATIVE SOLUTIONS-ORIENTED COMPUTATIONAL ENGINEER
Upstream Oil & Gas / Marine / Coastal

Effective Strategic Partner who Provides Practical Solutions to Challenges in Hydrodynamics, Waves, Floating Structures

Dr. Narayanaswamy specializes in using computational modeling to develop practical solutions to challenges in coastal flooding, hydrodynamics, waves, fixed and floating structures. His technical strengths include 2D and 3D wave and hydrodynamic modeling (ADCIRC, MIKE, Delft3D, STWAVE, WAM, SWAN, FUNWAVE, REFDIF) and statistical analysis of big data, including winds, waves, currents, and water levels. He has led the hydrodynamic and wave model development and validation efforts using ADCIRC, SWAN, WAM, and STWAVE for the FEMA Region X and Region V Flood Insurance Studies. Recently he also led the low-frequency (2, 1, and 0.2 percent) statistical stillwater surface development studies for FEMA Region IV. He has experience working with clients in the public and private sectors, spanning the coastal, marine, and upstream oil and gas industries. Currently he is working on efficient approaches to address to compound flood risk due to surge, sea level rise, and riverine flooding as part of the Louisiana Watershed Initiative. Dr. Narayanaswamy's expertise has been recognized by the National Institute of Building Sciences, where he serves on the Scientific Resolution Panel, an independent group of experts called upon to review challenges to the accuracy of FEMA's flood analysis and mapping.

PROFESSIONAL EXPERIENCE

Senior Technical Consultant, Michael Baker International   2016 to Present

Responsible for coastal engineering technical leadership and Subject Matter Expertise, business development and strategic initiatives to expand the national coastal engineering business. **He is responsible for bringing in more than $15 Million worth of coastal engineering projects of national importance**. *Additionally, he is currently the Subject Matter Expert on multiple critical projects across the United States.*

Marine Corps Base Camp Lejeune, Hurricane Florence Recovery, NAVFAC Mid Atlantic. Subject Matter Expert. Technical lead for metocean modeling of 695 JPM-OS hurricanes to determine bridge low chord, scour estimates, and wave loads. The modeling is being conducted using ADCIRC+SWAN on 96-core machines through automated Python scripts.

Bulkhead Condition Assessment and Repair Designs, Naval Station Newport. NAVFAC. Subject Matter Expert. Technical lead for design of a rip-rap revetment following the USACE Coastal Engineering Manual. The design process leveraged hydrodynamic and wave data developed as part of the USACE North Atlantic Comprehensive Coastal Study (NACCS (2015)).

Louisiana Watershed Initiative. Subject Matter Expert. Leading technical team to address compound flooding impacts due to storm surge, sea level rise, and rainfall along 3 regions from New Orleans to Lake Charles. Collaborating with The Water Institute, USACE New Orleans District on developing consistent state-of-the-art methodology to accurately develop statistical estimates of flood risk.

Storm Surge Studies, Nationwide. FEMA Region IV. Subject Matter Expert. Led statistical post-processing to determine 2-, 1-, and 0.2-percent water levels from ADCIRC+SWAN storm surge modeling results of more than 300 hurricanes developed using a JPM-OS approach.

JFK Airport Kilo4 Runway Expansion. Port Authority of NY & NJ. Technical Manager. Technical lead for scour, run-up and overtopping assessment using XBeach for design of bulkheads associated with this

runway expansion. The design process leveraged hydrodynamic and wave data developed as part of the USACE North Atlantic Comprehensive Coastal Study (NACCS (2015)).

New York City Future Flood Risk Maps, NYC Mayors Office of Resilience. Subject Matter Expert. Leading a team to determine extents of 1% and 0.2% flood risk in the City in 2050, 2080, and 2100 due to compounding impacts of sea level rise and climate change. The results of this study will be used to inform resilient building codes to ensure sustainable design of the City now and in the future.

Mississippi Coastal Flood Study, Gulfport, Mississippi. Southern Mississippi Planning and Development District. Subject Matter Expert. Leading the ADCIRC+SWAN hurricane surge modeling efforts to estimate the 2-, 1-, and 0.2-percent annual exceedance probabilities along the entire Mississippi coastline. Michael Baker is performing a coastal flood risk study for the entire Mississippi coastline, including coastal analysis, mapping, Digital Firm (DFIRM) production, preliminary and post-preliminary process support, and community engagement and public outreach. The Mississippi Coastal Map Revision Project is a grassroots movement, where the state is bearing the responsibility for the preparation of the Physical Map Revision, in accordance with guidelines established by FEMA.

Ocean Drive Bridge, Cape May, New Jersey. New Jersey Department of Transportation. Hydrodynamic and Wave Modeling. Subject Matter Expert. Developed strategy for an efficient Level III coastal modeling effort to determine low chord elevation requirements. Modeling involved analyses of more than 10 synthetic hurricanes using site-specific high-resolution ADCIRC+SWAN coupled hydrodynamic and wave models. The high-resolution models were used to generate 100-year wave and total water level conditions for determination of low chord elevation.

Erosion Mitigation at Front Beach, Ocean Springs, Mississippi. Jackson County Board of Supervisors. Subject Matter Expert. Led a team to evaluate the root cause of observed increased rates of erosion at Front Beach. This involved an assessment of longshore and cross-shore sediment transport due to local tides and waves. Additionally, the impacts of surface water runoff were assessed, and mitigation solutions were proposed.

Senior Engineer, ABS Consulting   2012 to 2016

Mooring Analyses (Ecopetrol, CNOOC, Texas Gulf Engineering, Jordan Cove LNG)
- Led a team of engineers to provide strategic input to assess the impact of Post-Panamax vessel traffic in the Houston Ship Channel on the existing and proposed ship docks at Stolthaven Houston.
- Developed Project Execution Plan, schedule, and implemented a hydrodynamic model to provide alternatives to mitigate the impact of increased passing ship loads on mooring lines, and fenders.
- Team lead to assess the feasibility of using an existing dock as a lay-by berth for Moss, Q-Flex, and Q-max LNG tankers at Jordan Cove LNG terminal. Provided recommendations to the client on optimal fender configurations and placement of additional bollards.
- Provided critical input supporting a bid for a FSRU terminal FEED study in the Port of Mumbai.
- Conducted a feasibility study to determine the suitability of a MBM terminal to handle 80,000 - 120,000 MT Aframax tankers and provided recommendations on maximum allowable tanker size.

Global Leg Strength Analysis of a Jack-up Platform (ABS Egypt)
- Nonlinear structural finite element analysis of a Jack-up rig to assess remnant strength in the corroded truss legs and update the extreme operating criteria to satisfy ABS class requirements.
- Extended the study to quantify relationship between reductions in leg thicknesses and extreme environmental loads and submitted an abstract to the 2014 SNAME Maritime Convention.

Design Life Extensions of Floating Assets (Chevron, Petrobras Americas Inc., Noble Energy)
- Collaborated, as a team of 2, on a white paper outlining a robust methodology for life extension of TLP assets in the Gulf of Mexico.
- Provide strategic input to numerous studies on extending the original design life of ageing floating structures. The projects include estimation of changes to design metocean criteria, assessment of structural integrity through data analysis and numerical modelling, and advising clients on life extension feasibility in terms of cost, time, safety and regulatory requirements.

Proposal Management
- Proposal Manager for response to a RFP on design of a numerical wave tank for NIOT India, and for response to a RFP on the global economic costs of corrosion for NACE International. Assembled a pool of Subject Matter Experts, and allocated resources to develop technical and financial proposal.

Internal Group Development
- Initiated an internal quarterly newsletter to provide a forum to address the challenges presented by the downturn in oil prices and brainstorm group development ideas and motivational alternatives.

Senior Engineer and Project Engineer, WS Atkins Inc.   2010 to 2012

FEMA RiskMAP (Client: Federal Emergency Management Agency)
- Metocean data analysis, hydrodynamic and wave modeling in the Great Lakes and the Pacific North West to estimate the 100 year water levels using extreme value analyses (GPD).
- Member of a strategy team, led by the U.S. Army Coastal and Hydraulics Laboratory, to finalize the statistical analysis methodology to compute extreme water levels in the Great Lakes.

Levy County Nuclear Power Plant Certification (Client: Sargent and Lundy)
- Team lead for the computation of probable maximum hurricane induced storm surge at a nuclear power plant using Monte Carlo water level modeling using SLOSH and Nuclear Regulatory Guide 1.59.

Construction Management of Ship Dock Expansion (Client: Vopak Terminal Deer Park)
- Part of a construction management team of 6 for the USD 50 million expansion of a bulk liquid marine terminal on the Houston Ship Channel. The terminal was delivered On-Time and On-Budget.

Project Engineer, Halcrow (a CH2M Company)   2009

- Generated a desktop wave hindcast of operational wind waves for Australia-Pacific LNG.
- Analyzed currents data obtained from a MIKE3 hydrodynamic model of a LNG Terminal.
- Waves and current data analysis from a Teledyne-RDI Workhorse Sentinel ADCP
- Volume of Fluid (RANS-VOF) modeling for wave overtopping at Falmouth Cruise Terminal.
- Developed visualization software for RANS-VOF model results using Paraview.
- Numerical modeling (MIKE21) of an intake channel to assess maintenance dredging intervals.
- Studied internal diffuser hydraulics for outfall designs to estimate power requirements.

Consultant, Surfrider Foundation   2006

- White paper - Policy on erosion due to artificial surfing reefs, **Cited in Nature Vol 444**.

EDUCATION AND CERTIFICATIONS

Professional Engineer, Ocean Engineering, Registered in Texas, PE No. 110147

Johns Hopkins University, Whiting School of Engineering   **Baltimore, MD**
Ph.D. and Master of Science in Civil Engineering   **2002 − 2008**
A hybrid finite difference Boussinesq-Smoothed Particle Hydrodynamics (SPH) wave propagation model.

Universidade De Vigo, Faculty of Science   **Ourense, Spain**
Visiting Research Scientist   **2005**
Collaborated and released a compressible SPH model: SPHYSICS: http://goo.gl/2kYHYh

University of Delaware, Center for Applied Coastal Research   **Newark, DE**
Research Assistant   **1999 − 2002**
Analysis of turbulence under breaking waves using image processing of laboratory experiments.

Indian Institute of Technology   **Kharagpur, India**
B.Tech (Hons) in Ocean Engineering and Naval Architecture   **1995 − 1999**

COMPUTATIONAL SKILLS

Languages: Matlab, FORTRAN77/95, C, Octave, MPI on Linux, Python.

Software: ANSYS Mechanical, AQWA, OPTIMOOR, FEMAP, ABS Eagle FPSO, MIKE, ADCIRC, STWAVE, FUNWAVE, CorHyd, Paraview

PUBLICATIONS

- Narayanaswamy, M., Lewis, D., Hua, D., & Graf, T. (2014). Environmental limits and corroded leg thicknesses for a jack-up structure. Accepted to the 2014 SNAME Ship Production Symposium.

- Gomez-Gesteira M., Rogers, B. D., Crespo, A. J. C., Dalrymple, R. A., Narayanaswamy, M., & Dominguez J. M. (2012). SPHysics – development of a free-surface fluid solver – Part 1: Theory and formulations. *Computers & Geosciences, V 48, 289-299.*

- Narayanaswamy, M., Crespo A. J. C, Gomez-Gesteira M., & Dalrymple R. A. (2010). SPHysics-FUNWAVE hybrid model for coastal wave propagation. *Journal of Hydraulic Research, V 48, 85-93.*

- Gómez-Gesteira, M., Rogers, B. D., Dalrymple, R. A., Crespo, A. J. C., & Narayanaswamy, M. (2010). User guide for the SPHysics code v2. 0.

- Narayanaswamy, M., Shi, F., Misra, S., & Schulte, R. (2010). Optimization of caisson breakwaters using a 2DV RANS-VOF model. *32th Intl. Conference on Coastal Engineering*.

- Dalrymple, R. A., Gomez-Gesteira, M., Rogers, B. D., Panizzo, A., Zuo, S., Crespo, A. J. C., Cuomo, A. G., Narayanaswamy M (2008). Smoothed Particle Hydrodynamics for Water Waves. *Advances in Numerical Simulation of Nonlinear Water Waves*. World Scientific Press.

- Dalrymple, R. A., Rogers, B. D., Narayanaswamy, M., Zou, S., Gomez-Gesteira, M., Crespo, A. J. C., & Panizzo, A. (2007). Smoothed Particle Hydrodynamics for Water Waves. *Proc. 25th Intl Conf on Offshore Mechanics and Artic Engineering*. ASME

- Narayanaswamy, M., Frandsen, J., & Dalrymple, R. A. (2007). SPH Modeling of Forced Waves. *SPHERIC Second Intl. Workshop, Madrid*.

- Narayanaswamy, M., Frandsen, J., & Dalrymple, R. A. (2006). Experimental and Numerical Studies of Forced Free Surface Waves. Proc. *30th Intl. Conference on Coastal Engineering.*

- Narayanaswamy, M. & Dalrymple, R. A. (2005). A Hybrid Boussinesq and SPH Model for Forced Oscillations. *Symposium on Ocean Wave Measurements and Analysis. ASCE.*

- Narayanaswamy, M. & Dalrymple, R. A. (2004). Earthquake Induced Wave Motions in Closed Water Bodies. *Proc. 29th Intl. Conference on Coastal Engineering. World Scientific Press.*

- Narayanaswamy, M. & Dalrymple, R. A. (2002). An Experimental Study of Surface Instabilities During Wave Breaking. Proc. *28th Intl. Conference on Coastal Engineering. World Scientific Press.*