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**Abstract:** Offshore oil and gas reserves account for billions of barrels of oil and trillions of cubic feet of natural gas predicted to lie within federally controlled waters in the Gulf, including off the coast of Texas. The major problem is that these reserves lie underneath 10,000 feet of water, presenting costly unprecedented engineering challenges within a depressed market. The technical challenges in designing reliable oil producing systems in this environment manifest themselves as (i) heat transfer of multi-phase flow within pipes, (ii) fluid-solid interactions of flexible structures (risers and pipelines), (iii) materials reliability in the presence of corrosion (due to sea water) and (iv) integration and control of the complete subsea system. Presented is a model-based methodology identifying subsea field architectures that satisfy pre-specified multi-physics constraints. The proposed methodology prioritizes the identified subsea system based on production flow rates, and OPEX and CAPEX costs. The architecture solutions produce facility positioning and optimal pipeline routing/sizing. A convex combination approach creates the multi-objective optimization criterion enabling weighting among constraints such as hydraulic, topological, structural, flow assurance as well as technical issues and financial limitations. The optimization problem is computationally solved using a hybrid method employing a global multi-start algorithm that combines a scatter search process with a gradient-based local nonlinear problem solver. A case study is provided to demonstrate the proposed methodology including the impact of varying the weights among of the constraints. Case studies will be included.

**Bio:** Dr. Matthew Franchek is a professor of Mechanical Engineering at the University of Houston with joint appointments in Subsea Engineering and Biomedical Engineering. He received his Ph.D. in Mechanical Engineering from Texas A&M University in 1991. He started his career at Purdue University as an assistant professor in Mechanical Engineering. He was promoted to an associate professor with tenure in 1997 and then to full professor in 2001. While at Purdue, he initiated and led two industry supported interdisciplinary-research programs: Automotive Controls Research Program and an Electro-Hydraulic Research Program.

From 2002 to 2009 he served as Chair of Mechanical Engineering at UH while simultaneously initiating the UH Biomedical Engineering undergraduate program. After his terms as the Mechanical Engineering Department Chair and Director of Biomedical Engineering, Dr. Franchek worked with Houston area companies to create the nation's first subsea engineering program and is the founder of the Global Subsea University Alliance.

Dr. Franchek's research program focuses on low dimensional modeling and model-based methods that enable automated simulation-based design, and real-time adaptive physics-based data analytics. His methods in real-time monitoring and forecasting have been applied to aerospace, automotive, biomedical and energy systems. He has authored over 100 archival publications, and over 130 conference publications. He has served as the advisor to 28 doctoral students and 36 masters students.