

Statement of Research Interests

Ahmed Elmekawy, PhD, P.E.

E-mail: elmekawy84@gmail.com

My research interest is the area of **Finite Element Analysis, Computational Fluid Dynamics, Turbulence modelling and Fluid-Structure Interaction**. I am interested in understanding the physical process and simulating it computationally.

Many problems involve structure and fluid interaction. Modeling it as a fluid problem only will not yield good results.

Based on my previous research experience and practical experience as research and development engineer and a consultant, I was able to publish 1 us patent, 1 journal paper and 5 conference papers.

I also submitted to research proposal to the academy of scientific research and technology (ASRT) in Egypt and National Science Foundation (NSF) in US with a collaboration with two US universities (Michigan Tech and Texas A&M) in the following fields:

- Design, Manufacturing and Testing of Egyptian Electrical Car
- Assessment, optimization, and control of Wave Energy Converters Arrays in Egypt

Previous Research

- Rotordynamics of a rotor supported on magnetic bearings: A finite element Matlab code was written to model the rotor by using finite-element analysis. A PID controller was used to control the magnetic bearing. A comparison between the simulation and experimental results was conducted and showed that the model simulates the problem physics successfully.
- F/A-18 Twin-Tail Buffet Using Non-Linear Eddy Viscosity Turbulence Models: Effect of using new turbulence models on the CFD model of the vortex over delta wing. The effect of vibration of the fighter tail on the breakdown of vortices were studied. A fluid-structure interaction Ansys model was used to compare the simulation results with experimental data. Better results were obtained by the model when compared with other researcher results.
- Optimization of hydraulic tool used to install rivets in mechanical splices for belt conveyor systems. Finite Element Analysis models and system mathematical models were used during the optimization process.
- Motion and Stress analysis for rotary tools used to install mechanical splices for belt conveyor systems.

Current and Future research

I am currently working on several topics of Fluid-Structure Interaction simulations such as

- Journal Bearing and rotor dynamic modelling.
- Identification of two phase flow pattern in pipelines by measuring the vibration on pipeline surface. A Fluid-Structure interaction model is developed to compare results with experimental data.
- Shell and tube heat exchanger design validation by simulating the flow of one of the fluids around baffles. CFD and Finite Element models are used to compare the results with experimental data.
- Fluid Structure Interaction Simulation of Horizontal Axis Wind Turbine.
- Blade Shape optimization for Helicopter Rotor Blades