Modeling Gust in Model Reduction Framework

MEHDI GHOMMEN, IMRAN AKHTAR, MUHAMMAD HAJJ, ISHWAR PURI, Virginia Tech — Determining gust effects on fluid flows and fluid structure interactions is important in many applications. Direct numerical simulations of these effects may be very expensive. This is especially true in cases where gust parameters could vary. The overall goal of this effort is to develop tools and reduced-order models that are capable of assessing gust effects and that can be used for flow control or uncertainty quantification of flow parameters. As such, we simulate the flow past a circular cylinder with and without an incoming gust. Proper orthogonal decomposition (POD) is performed on the simulated flow data to compute the dominant basis functions (modes) using the method of snapshots. The results show that reduced-order models from steady flow cannot be readily used to develop reduced-order models for the same flow with incoming gust. Methodologies to incorporate gust effect within the reduced-order model are discussed.

Imran Akhtar
Virginia Tech

Date submitted: 11 Aug 2009