A Tutorial on Finite Element Analysis of Straight-Tube Coriolis Flowmeters

It has been more than fifteen years since finite element method was implemented to the analysis of Coriolis flowmeter. While most of the literature provided only part of the procedures on constructing the matrix system equations which is to be solved for the natural frequencies and mode shapes. In this paper, we intend not only to provide a detail derivation on the governing equations via Hamilton's principle, but also to determine the weak form of equations of motion by virtue of Lagrange's equation, instead of going through a tedious variational or weighted residual method. The formulation is based on the assumptions that the pipe was represented as a Timoshenko beam possessing stiffness and mass while the fluid was idealized as incompressible and in viscid.