Cardiovascular diseases (CVDs) are the preeminent causes of death in the world. There are, annually, more than 300,000 heart valves implanted worldwide, and about 85,000 heart valve replacements in the US, while approximately half of them are mechanical valves. Hence, understanding of normal cardiac functions and diseases is vital for diagnostics and treatments. Modeling of hemodynamics, Computational fluid dynamics (CFD), enables a comprehensive analysis of flow in normal as well as diseased hearts. CFD is the potential to serve as decision-making aid and can support, enhance and explain clinical observations by providing detailed information of the blood flow. This information might not be accessible with in-vivo measurements. On the other hand, finite element method (FEM), also called finite element analysis (FEA), is an efficient way to analyze the interactions of blood flow with blood vessel and tissue layers. Here, a new FEM is presented to investigate the flow-induced sound generation and propagation of sound waves through a tissue-like material. This method is based on mapping the transient pressure (force) fluctuations on the vessel wall and solving for the structural vibrations in frequency domain. These vibrations were detected as sound on the epidermal surface. Advantages of the methods used in the current study include: (a) capability of providing accurate solution with a faster solution time; (b) accurately capturing the break frequency of the velocity fluctuation measured on epidermal surface; (c) inclusion of the fluid-structure interaction between blood flow and the arterial wall.

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The public is welcome to attend.