

Applications of continuum mechanics in cardiology

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Cardiac mechanics goes back to Laplace's law of the heart. In its simplest form given by Laplace's law, ventricular wall stress is directly proportional to the diameter of the ventricle and the ventricular pressure, and is inversely proportional to the wall thickness of the ventricle. This helps to explain why heart failure (occurs when the heart muscle doesn't pump blood as well as it should) is a progressive disease. However, the finite element method allows for patient-specific mathematical modeling of the efficacy of novel surgical procedures and medical devices for treating the World-wide heart failure epidemic. I shall discuss rules of thumb that cardiologists and cardiac surgeons can apply to all heart failure patients that we discovered using continuum mechanics, like, for example, do not remove any heart muscle, even poorly contracting muscle, that would otherwise contribute to the overall pumping performance of the heart.