Abstract:
Since the first procedure in 2002, there has been an explosive growth in transcatheter aortic valve replacement (TAVR). By the end of 2011, about 70,000 TAVRs have been performed worldwide. Short- and medium-term outcomes after TAVR are encouraging with significant reduction in rates of death. However, adverse events associated with TAVR have been detected, including stroke, myocardial infarction, peripheral embolism, injury to the aorta, perivalvular leak, and access site injury. Furthermore, long-term durability and safety of these valves are largely unknown and need to be evaluated and studied carefully. Successful deployment and function in TAVR is heavily reliant on the tissue-stent interaction. For instance, excessive radial force of the stent may cause aortic injury, while insufficient force may lead to paravalvular leakage and device migration. Therefore, a better understanding of the aortic tissue-TAV interaction is critical to TAVR success.

The present work described experimental approaches to measure expansion forces of in-house self-expanding TAV stents, investigate aortic tissue behaviors, and examine rupture potential after the TAV stents were deployed into ovine and porcine hearts. In this research effort, we established a methodology to study TAV device/aortic root interactions by quantifying important tissue-stent contact parameters during deployment. It is hoped that the established methodology will help us understand characteristics of tissue-stent interactions and provide insight into TAVR device design improvements.