

Arterial Compliance Measurement Using Split Cylinder Sensor/Actuator

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Abstract : Coronary stents are devices resembling the shape of a tube which are placed in coronary arteries, to keep the arteries open in the treatment of coronary arterial diseases. Coronary stents are routinely deployed to clear atheromatous plaque. The stent essentially applies an internal pressure to the artery because its structure is cylindrically symmetrical and this may introduce some abnormalities in final arterial shape. The goal of the project is to develop segmented circumferential arterial compliance measuring devices which can be deployed (eventually) in vivo. The segmentation of the device will allow the mechanical asymmetry of any stenosis to be assessed. The purpose will be to assess the quality of arterial tissue for applications in tailored stents and in the assessment of aortic aneurism. Arterial distensibility measurement is of utmost importance to diagnose cardiovascular diseases and for prediction of future cardiac events or coronary artery diseases. In order to arrive at some generic outcomes, a preliminary experimental set-up has been devised to establish the measurement principles for the device at macro-scale. The measurement methodology consists of a strain gauge system monitored by LABVIEW software in a real-time fashion. This virtual instrument employs a balloon within a gelatine model contained in a split cylinder with strain gauges fixed on it. The instrument allows automated measurement of the effect of air-pressure on gelatine and measurement of strain with respect to time and pressure during inflation. Compliance simple creep model has been applied to the results for the purpose of extracting some measures of arterial compliance. The results obtained from the experiments have been used to study the effect of air pressure on strain at varying time intervals. The results clearly demonstrate that with decrease in arterial volume and increase in arterial pressure, arterial strain increases thereby decreasing the arterial compliance. The measurement system could lead to development of portable, inexpensive and small equipment and could prove to be an efficient automated compliance measurement device.

Keywords : arterial compliance, atheromatous plaque, mechanical symmetry, strain measurement

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