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Impacts of coronary artery eccentricity on macro-recirculation and pressure drops using computational fluid dynamics[1] ERIC POON, VIKAS THONDAPU, PETER BARLIS, ANDREW OOI, Univ of Melbourne —
Coronary artery disease remains a major cause of mortality in developed countries, and is most often due to a localized flow-limiting stenosis, or narrowing, of coronary arteries. Patients often undergo invasive procedures such as X-ray angiography and fractional flow reserve to diagnose flow-limiting lesions. Even though such diagnostic techniques are well-developed, the effects of diseased coronary segments on local flow are still poorly understood. Therefore, this study investigated the effect of irregular geometries of diseased coronary segments on the macro-recirculation and local pressure minimum regions. We employed an idealized coronary artery model with a diameter of stenosis of 75%. By systematically adjusting the eccentricity and the asymmetry of the coronary stenosis, we uncovered an increase in macro-recirculation size. Most importantly, the presence of this macro-recirculation signifies a local pressure minimum (identified by λ_2 vortex identification method). This local pressure minimum has a profound effect on the pressure drops in both longitudinal and planar directions, which has implications for diagnosis and treatment of coronary artery disease.

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