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Toward non-Newtonian effects on secondary flow structures in a 180 degree bent tube model for curved arteries STEVIN VAN WYK, LISA PRAHL WITTBERG, LASZLO FUCHS, Linne FLOW Center, KTH, Stockholm, Sweden, KARTIK V. BULUSU, MICHAEL W. PLESNIAK, The George Washington University — The purpose of this study is to investigate the development of vortical flow structures of blood like fluids in a 180 degree tube bend, analogous to the aortic arch. Cardiovascular diseases are localized to regions of curvature in the arterial tree. The pathology of atherogenesis is widely considered an inflammatory response, hypothesized to be modulated by the interplay between Wall Shear Stress (WSS) variations and particulate transport mechanisms from the bulk fluid core to the near wall. The WSS is determined by the local flow characteristics as well as the rheological properties of the blood, which in turn are dependent on the bulk secondary flows. In this work, the time dependent fluid flow under various physiological flow conditions are investigated both experimentally and numerically. A Newtonian blood analog fluid model is considered in both studies to validate both methods and thereby study flow structure development during steady as well as pulsatile conditions. Particle image velocimetry (2C – 2D PIV) is used to acquire velocity field data from an acrylic tube bend. The numerical study is extended to consider the non-Newtonian properties of blood according to an empirical model to identify the relative importance of the non-Newtonian behavior. The studies show complex Dean and Lyne vortex interaction that are enhanced with increasing peak Reynolds numbers.

Stevin van Wyk
Linne FLOW Center, KTH, Stockholm, Sweden

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