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Pulsatile Flow Across a Cylinder–An Investigation of Flow in a Total Artificial Lung YU-CHUN LIN, JOSEPH BULL, The University of Michigan — The effect of pulsatility on flow across a single cylinder has been examined experimentally using particle image velocimetry. This work is motivated by the ongoing development of a total artificial lung (TAL), a device which would serve as a bridge to lung transplant. The prototype TAL consists of hollow microfibers through which oxygen-rich gas flows and blood flows around. Flow through the device is provided entirely by right heart and, therefore, is puslatile. The Peclet number of the flow is large and consequently the development of secondary flow affects the resulting gas exchange. The effects of frequency and average flow rate of pulsatile flow around a cylinder were investigated experimentally in a water tunnel and some of the results were compared with preliminary numerical results. Vortices developed behind the cylinder at lower Reynolds numbers in pulsatile flow than steady flow. The results indicate that there are critical values of the Reynolds number between 3 to 5 and Stokes numbers of 0.22, below which vortices were not observed. The findings suggest that higher Stokes and Reynolds numbers within the device could enhance vortex formation. However, this enhanced gas exchange could be at the expense of higher device resistance and increased likelihood of blood trauma. Intelligent TAL design will require consideration of these effects. This work is supported by NIH grant HL69420.

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