A Multiscale Closed-Loop Cardiovascular Model, with Applications to Heart Pacing and Hemorrhage DANIEL CANUTO, JEFF ELDREDGE, KWITAE CHONG, PEYMAN BENHARASH, ERIK DUTSON, Univ of California - Los Angeles — A computational tool is developed for simulating the dynamic response of the human cardiovascular system to various stressors and injuries. The tool couples zero-dimensional models of the heart, pulmonary vasculature, and peripheral vasculature to one-dimensional models of the major systemic arteries. To simulate autonomic response, this multiscale circulatory model is integrated with a feedback model of the baroreflex, allowing control of heart rate, cardiac contractility, and peripheral impedance. The performance of the tool is demonstrated in two scenarios: increasing heart rate by stimulating the sympathetic nervous system, and an acute 10 percent hemorrhage from the left femoral artery.

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