Docket #: S08-409

Software subroutines for modeling cardiac pressure-volume relationship and coronary blood flow

Stanford researchers at the Taylor Lab have developed software subroutines that can be used together with the open source software system Simvascular to improve the simulation of blood flow in modeling coronary arteries. These subroutines implement lumped parameter heart models and coronary boundary condition models to three-dimensional finite element models of the aorta and coronary arteries. These methods have been demonstrated to yield physiologically realistic pressure and flow waveforms in coronary circulation and can be used for purposes of understanding mechanisms of coronary artery disease, designing coronary devices or planning interventions.

Related Technology from Taylor Lab:
S09-333 "Software subroutines to construct opensource software for comprehensive cardiovascular modeling and simulation"

Applications

- **With open source Simvascular software** - extends Simvascular to modeling coronary artery blood flow and pressure
- **Research and education** - e.g. understanding mechanisms of coronary artery disease, designing coronary devices or planning interventions

Advantages

- Enables **non-invasive** diagnostics of heart disease
- **Personalized medicine,** specific to patient

- **Improves SimVascular software by** modeling coronary artery blood flow and pressure
- **More robust and numerically stable** than existing methods

Publications

- US Patent US20100241404A1 - Patient-specific hemodynamics of the cardio vascular system
- Kim, Hyun Jin, Irene E. Vignon-Clementel, C. Alberto Figueroa, John F. LaDisa, Kenneth E. Jansen, Jeffrey A. Feinstein, and Charles A. Taylor "On coupling a lumped parameter heart model and a three-dimensional finite element aorta model."*Annals of biomedical engineering* 37, no. 11 (2009): 2153-2169
- Kim, H. J., I. E. Vignon-Clementel, J. S. Coogan, C. A. Figueroa, K. E. Jansen, and C. A. Taylor. "Patient-specific modeling of blood flow and pressure in human coronary arteries." *Annals of biomedical engineering* 38, no. 10 (2010): 3195-3209.

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