

Cardiovascular Model for Development and Test of Automated Hemodynamic Regulation with Medication

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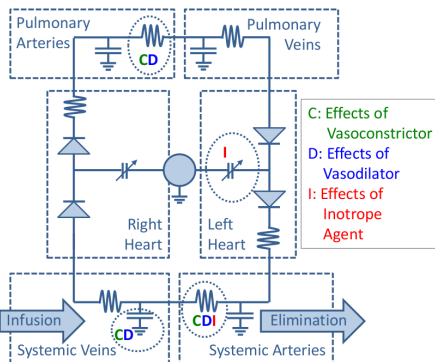
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After cardiac surgery patients are moved to the intensive care unit for recovery. Physicians assess the patients hemodynamic state every now and then and apply medication when needed. This time consuming task may be done by an automated hemodynamic regulation. This allows a more continuous regulation reducing the time of recovery and allowing doctors to attend more critical tasks. To develop such a controller, extensive tests and evaluation of its performance in different situations is needed. In-vivo experiments with animals are costly for the budget, the time effort and the animals life. That is why an adequate simulation environment is highly desirable.

A simulation allows the reduction of animal experiments while still ensuring extensive evaluation of the automated regulation in simulations. The proposed model is able to simulate the human cardiovascular system continuously. It is possible to simulate different common disorders. Also adequate reactions to four different types of drugs were implemented in a pharmacokinetic and a pharmacodynamic model.



Circulation model with pharmacokinetic and pharmacodynamic model

As vasodilator isosorbide dinitrate was implemented, vasodilator used is norepinephrine and inotrope agent is dopamine. The behaviour of the simulation for the disorders and reactions upon medication infusion were configured to fit data collected from previous animal experiments.