Load-induced aortic insufficiency in LVAD patients: a model study
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Introduction
Heart failure
Heart failure is a syndrome that affects up to 10% of the population over 65 years of age. In 90% of the cases, the size of the heart has increased markedly, leading to poor cardiac output and blood pressure, requiring heart transplantation in the end.
LVADs
To bridge the gap between the time of necessity and availability of the donor heart, currently, a Left Ventricular Assist Device (LVAD) can be used. Such a blood pump partly takes over the function of the heart, so the patient can survive. With proper treatment (Birks et al, 2006), there is a possibility of recovery of the heart, such that after some time the pump can be explanted and the patient’s own heart resumes its function.
A common complication with constant-speed axial flow pumps is aortic valve insufficiency (AVI, see figure 1, Haghi et al, 2007) With AVI, the aortic valve does not close completely, thus reducing net outflow of the heart. In severe cases, this is a lethal condition.

Results
Average pump flow (Figure 2)
Average pressure load (Figure 3)
Valve duty cycle (Figure 4)

Conclusion
Even at moderate pump speeds, the opening behaviour of the aortic valve is impaired and loads are doubled. This will lead to remodeling responses in the valve, causing aortic insufficiency. For prevention, better pump control strategies are needed.

References:
Birks et al., N Engl J Med. 2006;355(18):1873-84
Haghi et al., J Heart Lung Transplant. 2007;26(11):1220-1