FSI Modeling of Thoracic Aortic Aneurysms

*Hiroshi Suito[1,5], Takuya Ueda[2,5], Kenji Takizawa[3,5] and Tayfun E. Tezduyar[4]

[1]Department of Environmental and Mathematical Sciences, Okayama University,
3-1-1, Tsushima-naka, Okayama, 700-8530, Japan
[2]Department of Radiology, St. Luke's International Hospital, Japan
[3]Department of Modern Mechanical Engineering and Waseda Institute for Advanced Study,
Waseda University, Japan
[4]Department of Mechanical Engineering, Rice University, USA
[5]CREST, Japan Science and Technology Agency, Japan
*Corresponding author: suito@ems.okayama-u.ac.jp

Aortic aneurysm is defined as a condition of dilatation of the aorta to greater than 1.5 times the normal diameter. Treatment of an aortic aneurysm may be surgical or endovascular repair, depending on the rupture-risk prediction. However, natural history of the development of aortic aneurysms has not been fully understood. In this study, we focus on the relationship between the original aorta morphology and the blood flow. We consider a number of patient-specific models of the thoracic aorta as constructed from CT scans. With prescribed artery motion, we compute the flow field with the variational multiscale (VMS) version of the Deforming-Spatial-Domain/Stabilized Space–Time method (DSD/SST-VMST). The results suggest that torsion is an important factor in the relation between the aorta morphology and the hemodynamics.

Keywords: FSI, Cardiovascular system, Aortic aneurysm