

*12<sup>th</sup> Seminar on Mechanical Science and Bioengineering*  
Graduate School of Engineering Science, Osaka University  
Room A347  
13:30 – 15:00, Monday, March 12, 2007

## **3D Models of Blood Flow in the Cerebral-Vasculature**

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The Circle of Willis (CoW) is a ring-like arterial structure located in the base of the brain, responsible for the distribution of oxygenated blood throughout the cerebral mass. Among the general population, approximately 50% have a complete CoW, where among a multitude of possible anatomical variations, vessels absent from the CoW are common. Certain conditions such as a build up of atherosclerotic plaque on the arterial wall can result in ischaemic damage and stroke-like symptoms. A 3D computer model has been developed based on the results of MRA scans of 3 patients cerebral-vasculature including a numerical algorithm to simulate the body's autoregulation mechanism. The intention of the present study was to investigate different anatomical states, including different vessels missing from the circle whilst occluding the main afferent arteries such as the Internal Carotid and Vertebral Arteries. Results show that variations in inflow characteristics causes peripheral resistances to change in order to maintain sufficient blood flow to the brain tissue. This indicates that 'pressure' is the more physiologically correct boundary condition as opposed to the specification of an inlet 'velocity profile'