# COMPUTATIONAL HAEMODYNAMICS IN ARTERIAL GEOMETRIES IN RELATION TO OBESITY-INDUCED CARDIOVASCULAR DISEASES

**Dr. Asimina Kazakidi**
University of Strathclyde

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ABSTRACT
Childhood and adolescent obesity, primarily a dietary disease, has become a major challenge of the modern society. Obesity is known to accelerate endothelial dysfunction, one of the key biological indicators of lesions of atherosclerosis that underlie most cardiovascular diseases. Early vascular changes can be clinically assessed with measurements of the aortic and carotid intima-media thickness (IMT), and flow-mediated dilatation (FMD) of the brachial, radial, femoral, or popliteal artery, induced by transient hyperaemia. The haemodynamic environment in high-risk patients is likely to be altered in a way that has not yet been clearly understood. This work will discuss the design and mesh generation challenges of idealised and anatomically-realistic vascular geometries, with the use of the ANSA® pre-processor (BETA CAE Systems SA), for the assessment of early signs of cardiovascular diseases in relation to obese children and adolescents. It will also present arterial models that attempt to clarify some of the flow-related mechanisms that are believed to contribute to early vascular changes. Numerical simulations of the time-dependent, incompressible Navier-Stokes equations will be presented utilising a high-fidelity finite volume solver in OpenFOAM®. The models help evaluate the haemodynamic shear stresses along the arterial walls and the possible location of early atherosclerotic lesions. Further work is ongoing on multi-scale computational modelling in patient-specific three-dimensional anatomies combining blood flow computations with macroscopic and microscopic features.