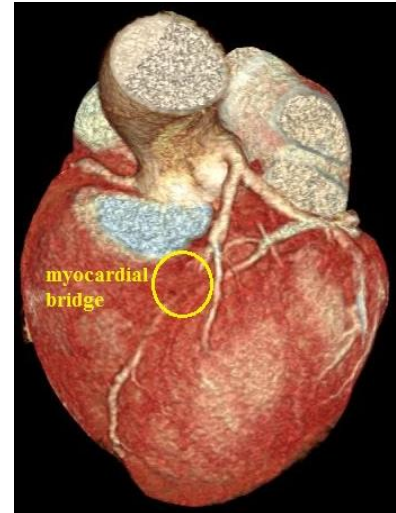


Disorders of the circulatory system and other related diseases, such as atherosclerosis, heart attacks and strokes are main cause of deaths in the world, especially in highly developed countries. Understanding of the basic phenomenon and mechanisms which appear in cardiovascular system could contribute to the early diagnosis and inhibition of the developing lesions of the blood vessels.

Atherosclerosis is the disease of the human circulatory system, primarily of the arteries. It leads to the narrowing of the vessel lumen leading to the blood flow diminution which results in hypoxia. Atherosclerosis causes the deposition of species carried by the blood such as cholesterol or monocytes. These substances attaching to the blood vessel wall create the atherosclerotic plaque. The accretion of the atherosclerotic plaque could cause its rupture, thrombus formation and in consequence, lead to the ischemia of the supplied by artery area.



The aim of the project is to identify, using computer modelling of blood flow (Computational Fluid Dynamics), the flow patterns that are promoting deposition of the atherosclerotic plaque in coronary arteries. It has been identified that prevalent localization of the plaques deposition coincides with the region of low-oscillatory flows. In coronary arteries such flow behaviour is characteristic to situations where the vessel lumen is compressed by heart muscle due to systole. This happens in the pathological case when the muscle layer is overlaying the vessel (myocardial bridge) or in physiological situation of artery branches inside muscle separating ventricles. In both cases, *during systole the artery is compressed yielding milking effect*, i.e. ejection of blood in up- and down-stream direction causing bidirectional blood flow.

The computer model will simulate pulsatile blood flow in coronary arteries. The shape of coronary vessel will be obtained from computed tomography medical images. The research will be executed by an interdisciplinary research team consisting of mechanical engineers, medicine doctors and computer scientists.

The research will shed light on the, not well recognized so far, question of the influence of the compression of the coronary arteries by the heart muscle and its impact on the atherosclerotic plaque deposition. The project will produce valuable input into future biochemical research on identification of dynamics of arteriosclerotic plaque deposition.