BP 31: Posters - Biotechnology and Bioengineering

Time: Tuesday 14:00–16:00 Location: P2-OG1

BP 31.1 Tue 14:00 P2-OG1

Synthesis and charcterization of magnetite nanoparticles with aminosilane coating — •Stefanie Fuchs, Maryam Youhannayee, and Mathias Getzlaff — Institute of Applied Physics, Heinrich-Heine-Universität, Düsseldorf, Germany

The interest in magnetic nanoparticles grew in the recent years due to a wide range of possible applications in technology and medicine. The most important ones in medical and biomedical science are their use as MRI contrast agent, in targeted drug delivery and in hyperthermia treatment. They show superparamagnetic property at room temperature from the aspect of magnetic properties and also biocompatibility and low toxicity from a biomedical point of view. Magnetite nanoparticles are synthesized from Ferric Chloride and Ferrous Sulphate via wet chemical coprecipitation method. In order to functionalize them we have tried three different methods to coat them with N-(2-aminoethyl)-3-aminopropyltrimetoxysilane (AEAPS). The aminosilane ligand shell increases the stability of magnetite nanoparticles in solution and also biocompatibility of iron seeds thorough injection. The obtained particles have been characterized with Fourier transformed infrared spectroscopy (FTIR), X-ray powder diffraction (XRD) and transmission electron microscopy(TEM) to study the morphological structure of particles.

BP 31.2 Tue 14:00 P2-OG1

Bionic electrolocation strategy of objects in fluids based on superposition of numerically extracted and shifted EEVs — •Sabine Wolf-Homeyer[1], Jacob Engelmann[2], and Axel Schneider[1] — [1]Bielefeld University of Applied Sciences, Germany — [2]Bielefeld University, Germany

Additionally to visual sense, weakly electric fish use electrolocation for navigation and to find food even in dark or turbid waters. Specialized muscle cells in the tail region generate a weak electric field around the fish's body. Sensed by electroreceptors on the animals' skin, distortion of the self-generated electric field, caused by objects, is perceived. Furthermore the fish executes scanning behavior to obtain additional sensory information like size, shape and material properties of detected objects in their vicinity. Inspired by the biological model, a fixed minimal scanning strategy, composed of active receptor-system movements, is developed. The aim of this strategy is the unique identification of object-positions. With the aid of a bio-mimetic abstraction of the receptor-system, a scanning-method for active electrolocation is developed. The method is based on the superposition of numerical extracted EEV- (Ensemble of Electrosensory Viewpoints) contour-rings [Solberg et al., International Journal of Robotics Research, 27(5), pp. 529-548], which are previously simulated by means of FEM. To identify an optimal scanning strategy, the uniqueness of object positions for permutations of sensor movement sequences was evaluated. The best resulting concatenation of receptor-system movements consists of the combination of a linear shift, a rotation and the original EEV.

BP 31.3 Tue 14:00 P2-OG1

Neutron Reflectometry Reveals Structural Aspects of Blood Protein Adsorption to Polymer Brushes — •Victoria Latza[1], Ignacio Rodriguez Loureiro[1], Irena Kiesel[2], Avraham Halperin[3], Giovanna Fragneto[2], and Emanuel Schneck[1] — [1]Max-Planck-Institut für Kolloid- und Grenzflächenforschung, Potsdam, Deutschland — [2]Institut Laue-Langevin, Grenoble, Frankreich — [3]Université Joseph Fourier, Grenoble, Frankreich

Protein adsorption to biomedical surfaces, for example of implants, is a major issue because it can lead to harmful foreign body reactions. Surface functionalization with hydrophilic polymer brushes is a common strategy to suppress undesired protein adsorption. However, numerous cases where this approach failed are reported and further investigation of the molecular mechanisms is required. Here, we use neutron reflectometry (NR) to characterize the adsorption of blood proteins to poly(ethylene glycol) (PEG) brushes grafted to planar phospholipid surfaces. The unique structural insights provided by NR allows distinguishing between different adsorption modes. For whole human blood serum the reflectivity curves show significant primary adsorption into the lipid head group region and suggest the presence of a low amount of ternary adsorption at the brush periphery. In context with the commonly neglected antigenicity of PEG we systematically characterize the structural aspects of antibody binding to polymer brushes with various chain lengths and grafting densities. To this end we obtained qualitatively different results for antibodies specific to the PEG end points and to the backbone.

BP 31.4 Tue 14:00 P2-OG1

The muscle lever arm: a key factor to muscle effectiveness in biomechanical models — •Maria Hammer and Syn Schmitt — SimTech, Universität Stuttgart

Pulling actuators play an important role in biomechanical simulations. In most animals, muscles are the actuators exerting torques onto the joints. These torques highly depend on the muscles' line of action or, in other words, muscle lever arms. Common methods focus either on single-joint movements, on two-dimensional problems, or on imitating physiological lever arms only in a small working range. However, especially in complex multibody simulations, where reduced descriptions of muscles as massless, visco-elastic bands are used, a correct representation of lever arms is mandatory for a large range of joint angles for all degrees of freedom.

To address these issues, we developed a new design and computational algorithm for modeling the path of linear pulling actuators. The method is based on finding the minimum potential energy path while the actuator is lead through a small number of two-dimensional shapes. It allows for multiple degree of freedom and high-amplitude movements as well as combinations of both, ensuring reasonable lever arms at all possible joint configurations even for muscles spanning more than one joint. We applied this method to a multibody model of the human musculoskeletal system.