2007 MAE Departmental Seminar Series

A New Methodology for Patient-specific Drug-Aerosol Targeting using a Smart Inhaler System

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Broughton Hall 1402

Summary - Drug-aerosol inhalation is a routine treatment method for chronic obstructive pulmonary diseases (COPD), including asthma. It is now also being considered to combat even more severe lung diseases as well as systemic ailments such as lung tumors, other cancers, diabetes, pain, etc. In any case, the problem is to bring appropriate medicine (usually very aggressive and quite expensive) to predetermined lung areas which are directly correlated with the subject's disease.

A new methodology (patent pending) for targeted drug-aerosol delivery and components of the associated smart inhaler system (SIS) are discussed, mainly in form of validated computer simulation results. Optimal targeting of inhaled medicine relies on suitable parameters for controlled air-particle stream delivery, tailored towards individual patients. Such quantitative results will be ultimately obtained via peta-scale (10^15) computing and used for the optimal, patient-specific operation of the SIS. First-generation prototyping of the smart inhaler is being carried out in collaboration with MAE Professors Stefan Seelecke and Bill Roberts as well as Dr. Jim Donohue, Chief of the Pulmonary Division at UNC-CH.

Mini-CV - Dr. Clement Kleinstreuer received his PhD from Vanderbilt University while working on research assignment at Oak Ridge National Laboratory, Energy Division. His first academic job was at Rensselaer Polytechnic Institute (Chem. Eng. Dept.) where he left after five years as an associate professor to focus more on fluid-particle dynamics problems in a mechanical engineering environment. In 1990 he was promoted to full professor, and a few years later he started to get interested in BME-related research projects. His present research areas are computational fluid-particle dynamics and fluid-structure interactions with applications to lung-aerosol dynamics, stented aneurysms, and nanofluid flow in microchannels.