MUDASSAR IMRAN, Arizona State University, PO Box 871804, Tempe, AZ 85287-1804, USA
The Model of Antibiotic Resistance in Biofilm

A mathematical model of the effect of antibiotics on bacterial biofilm is considered. According to the US National Institute of Health, "Biofilms are medically important, accounting for over 80% of microbial infections in the body", such as otitis media, the most common acute ear infection in children in the US. Biofilms are highly resistant to antibiotics. Consequently, very high and/or long-term doses are often required to eradicate biofilm-related infections. We consider a two-compartments, chemostat-based model where one compartment has a very high dilution rate as compared to the other compartment. The high dilution rate compartment represents the fluid environment and the low dilution rate compartment represents the stagnant biofilm environment. A constant supply of nutrient and a periodically fluctuating antibiotic agent is supplied to the high dilution compartment. The model assumes that antibiotic increases the death rate as its concentration is increased. We use persistence as well as global bifurcation results for a mathematical analysis of periodic solutions. The model consists of a system of non-autonomous differential equations which govern the dynamics of the bacteria in biofilm.

This is joint work with Hal Smith.