2023 年传染病动力学建模、分析与控制研讨会

为促进我校生物数学方向的发展，增强和国内同行专家的学术交流与合作，提高相关领域青年教师的学术水平和学术视野，在国家自然科学基金项目和国家外国专家项目等的支持下，由南京信息工程大学数学与统计学院举办的“2023 年传染病动力学建模、分析与控制研讨会”将于 2023 年 10 月 14 日至 15 日举行。

本次会议将邀请湖北民族大学刘志军教授、南京航空航天大学赵洪涌教授、赣南师范大学高淑京教授、黑龙江大学王金良教授、哈尔滨工程大学薛玲教授、上海海事大学吴孝钿教授等与会作报告与研讨。

一、会议时间：2023 年 10 月 14 日至 15 日

二、会议地点：藕舫楼 629 会议室

三、会议报告议程：

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<tr><td>10:10-10:50</td><td>薛玲</td><td>哈尔滨工程大学</td><td>Mathematical insights into the influence of interventions on sexually transmitted diseases</td><td rowspan="2">王金良</td></tr>
<tr><td>10:50-11:30</td><td>吴孝钿</td><td>上海海事大学</td><td>Analytical approach of pharmacokinetic models for drugs exhibiting sigmoidal Hill elimination</td></tr>
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四、会议联系人： 张学兵、Anum Shafiq、Temesgen Desta Leta

欢迎广大师生踊跃参加！

南京信息工程大学数学与统计学院
江苏省应用数学（南京信息工程大学）中心
江苏省系统建模与数据分析国际合作联合实验室
2023 年 10 月 10 日

附：**会议报告信息**

Stability and Hopf bifurcation analysis of a HTLV-I infection model with time-delay CTL immune response

刘志军

湖北民族大学

Abstract: This paper is devoted to proposing a mathematical model in order to explore the dynamics of HTLV-I (human T-cell leukemia virus type-I) infection, in which the closely related target cell-virus-immune system interaction and the time-delay cytotoxic T lymphocyte (CTL) immune response are taken into consideration. Firstly, we give the relevant lemma for the existence of feasible equilibrium points of the model, and then further certify the global asymptotic stabilities of the infection-free equilibrium (IFFE) E_1 and the immune-free equilibrium (IMFE) E_2. Furthermore, we research the existence of Hopf bifurcation (HB) occurring at the immune equilibrium (IE) E^* due to the influence of the delay bifurcation parameter. Also, the numerical simulations conrm this fact. In addition, we obtain the explicit expressions which determine the direction and stability of HB. Finally, a succinct discussion shows that the delay in CTL response can destabilize E^* and generate HB, but not affect stabilities of E_1 and E_2.

基于媒介寄主选择偏好的柑橘黄龙病数学模型的构建与分析

高淑京

赣南师范大学

摘要：柑橘木虱主要危害柑橘等芸香科植物，传播柑橘黄龙病病菌，其寄主选择偏好会影响柑橘黄龙病的传播与控制。本报告主要介绍两类柑橘黄龙病模型。首先，基于木虱的寄主选择偏好机理，构建木虱选择偏好下的柑橘黄龙病动力学模型，计算其传播阈值，理论分析模型的动力学性质，并通过数值模拟研究柑橘木虱的着陆偏好、取食偏好对疾病传播的影响。接着，根据柑橘木虱的迁飞性，引入逗留时间矩阵将斑块进行耦合，建

立木虱选择偏好下柑橘黄龙病时空异质模型，得到模型的全局基本再生数以及无病平衡点全局渐近稳定的条件。最后，通过数值模拟研究了柑橘木虱的偏好行为以及斑块的耦合强度对黄龙病传播扩散的影响。

Mathematical insights into the influence of interventions on sexually transmitted diseases

薛玲

哈尔滨工程大学

Abstract: In this talk, I present a mathematical model, which is used to analyze what factors cause the epidemics of sexually transmitted diseases (STDs) and how to eliminate or mitigate them. We analyze the conditions under which the equilibrium of the model switches among disease-free equilibrium, endemic equilibrium, and limit cycle. The threshold and trans-critical bifurcation show that the interventions for high-risk sexual behaviors of high-risk susceptible individuals can eliminate STDs. We find that sex education, influenced by the size of infected individuals and interventions, can effectively cut down the size of STDs.

Analytical approach of pharmacokinetic models for drugs exhibiting sigmoidal Hill elimination

吴孝钿

上海海事大学

Abstract: Reactions between substrate and enzyme commonly result in cooperative saturable kinetics, which is empirically exhibited by sigmoidal Hill elimination. This nonlinear elimination property has been recognized as one of the major issues for the drug efficacy and toxicity. In this talk, I will present the analytical solutions of drug concentration with time for the nonlinear pharmacokinetic models, which is expressed by a newly introduced transcendent H function. The explicit formulas for several pharmacokinetic surrogates, such as the clearance, elimination half-life and partial/total drug exposure, and the sensitivity to Hill coefficient are also developed. These findings elucidate the intrinsic quantitative structural properties of pharmacokinetic models with Hill elimination and provide new knowledge for nonlinear pharmacokinetics and guidance for rational drug designs. This is a joint work with Prof. Jun Li at Faculty of Pharmacy of University of Montreal in Canada.