

Nathanael Billy Basar, 2018, **Analisis Kestabilan dan Kontrol Optimal Model Matematika Pelaku Kriminal dan Non-Kriminal dengan Pendekatan Predator-Prey**. Skripsi ini dibawah bimbingan Dr. Fatmawati, M.Si. dan Abdulloh Jaelani, M.Si. Departemen Matematika, Fakultas Sains dan Teknologi, Universitas Airlangga, Surabaya.

ABSTRAK

Kriminalitas adalah suatu perilaku yang melanggar norma dan nilai yang telah ditentukan. Terdapat dua faktor yang dapat menyebabkan suatu individu melakukan tindak kriminal. Faktor tersebut adalah internal dan eksternal. Karena banyaknya jumlah kasus kriminal yang terjadi, maka model matematika pelaku kriminal dan non-kriminal diperlukan untuk mengetahui jumlah penyebarannya. Pada skripsi ini, digunakan model *predator-prey* untuk mempelajari interaksi yang terjadi antara populasi kriminal dan non-kriminal. Dalam skripsi ini dibahas tiga model kriminal dan non-kriminal, yaitu model pertumbuhan eksponensial, model logistik dan model penegakan hukum. Selanjutnya, akan dilakukan analisis kestabilan titik setimbang dari masing-masing model tersebut, serta penerapan kontrol optimal berupa upaya preventif (u). Berdasarkan analisis ketiga model, didapatkan titik setimbang kepunahan kedua populasi, titik setimbang kepunahan populasi kriminal dan titik setimbang koeksistensi. Dari analisis kestabilan, didapatkan bahwa titik setimbang kepunahan kedua populasi bersifat tidak stabil dan titik setimbang lainnya bersifat stabil jika memenuhi syarat tertentu. Selanjutnya, eksistensi dari variabel kontrol ditentukan melalui metode Prinsip Maksimum Pontryagin. Dari hasil simulasi numerik, dapat ditarik kesimpulan bahwa pemberian kontrol berupa upaya preventif (u) dinilai efektif dan efisien dalam mengurangi populasi kriminal.

Kata Kunci: Kriminal, non-kriminal, kestabilan, *predator-prey*, kontrol optimal

Nathanael Billy Basar, 2018, **Stability Analysis and Optimal Control Mathematical Model of Criminal and Non-criminal with Predator-Prey Approach**. This thesis under the guidance of Dr. Fatmawati, M.Si. and Abdulloh Jaelani, M.Si. Department of mathematics, Faculty of science and technology, Airlangga University, Surabaya.

ABSTRACT

Criminality is conduct that violates the norms and values which have been determined. There are two factors that can cause an individual conducting a criminal offence. These factors are internal and external. Due to the large number of criminal cases that is the case, then the mathematical model of criminals and non-criminals needed to know the total number of its spread. In this thesis, the predator-prey model is used to study interactions between criminal and non-criminal. In this thesis discussed three models of criminal and non-criminal, namely the exponential growth model, the logistic model and the law enforcement model. Afterwards, will be performed the analysis of the stability of the equilibrium point of each model, as well as the application of optimal control in the form of preventive effort (u). Based on the analysis of the three models, we obtained the extinction of both populations equilibrium, the extinction of the criminal population equilibrium and the coexistence equilibrium. Based on the analysis of stability, we obtained that the extinction of both populations are unstable and the others are stable with certain conditions. Next, the existence of a control variable is specified by the method of Pontryagin's Maximum Principle. The results of numerical simulation, indicated that the granting of a control in the form of preventive effort (u) is efficient and effective to reduce criminal population.

Key words: *Criminal, non-criminal, stability, predator – prey, optimal control*