INTISARI

ANALISIS KESTABILAN DAN KONTROL OPTIMAL MODEL MATEMATIKA PERUNDUNGAN DI SEKOLAH

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Pada skripsi ini akan dibahas model matematika *bullying* di sekolah. Dari model tersebut akan ditentukan titik ekuilibrium bebas *bullying* dan titik ekuilibrium endemik *bullying*, serta dicari bilangan reproduksi dasar. Kemudian akan dilakukan analisis mengenai kestabilan titik ekulibrium. Selanjutnya, dibahas mengenai masalah kontrol optimal perilaku *bullying* dengan tujuan meminimumkan pelaku dan korban. Kontrol akan diterapkan melalui kampanye anti *bullying* dan penegakan hukuman bagi pelaku. Masalah kontrol optimal tersebut akan diselesaikan dengan prinsip Minimum Pontryagin. Terakhir, dilakukan simulasi numerik untuk memverifikasi hasil analisis teoritis, yang menunjukkan bahwa penerapan kontrol kampanye dan penegakan hukuman efektif dalam meminimalkan kasus *bullying*.

Kata Kunci: SIR model, model matematika, *bullying*, titik ekuilibrium, bilangan reproduksi dasar, kontrol optimal, prinsip minimum Pontryagin.

ABSTRACT

STABILITY ANALYSIS AND OPTIMAL CONTROL IN MATHEMATICAL MODEL OF SCHOOL BULLYING

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In this thesis, a mathematical model of bullying in schools will be discussed. From this model, the bullying free equilibrium point and the bullying endemic equilibrium point, and the basic reproduction number are determined. Then, the stability of equilibrium points will be analyzed. Next, the optimal control problem of bullying behavior with the objective of minimizing the perpetrators and victims is discussed. The bullying free campaign and enforcement punishment for the perpetrators will be implemented as control variables. The optimal control problem will be solved using Pontryagin Minimum principle. Finally, a numerical simulation is carried out to verify the results of the theoretical analysis, which shows the effectiveness of implemention campaign control and punishment enforcement in minimizing bullying cases.

Keywords : SIR Model, mathematical model, bullying, equilibrium point, basic reproductive number, optimal control, Pontryagin Minimum Principle.