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## **Robustness of a two-strain dengue fever model with respect to asymmetry**

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### ABSTRACT

We analyse the effects of the symmetry of a two-strain compartmental dengue fever model. The model is an extension of the classical compartmental susceptible–infected–recovered (SIR) model where the exchange between the compartments is described by ordinary differential equations (ODE's). Two-strains of the virus exist so that a primary infection with one strain and secondary infection by the other strain can occur. There is life-long immunity to the primary infection strain, temporary cross-immunity followed by life-long immunity to the other strain after the secondary infection. Susceptible individuals can become infected with two different infection rates depending from whom they are getting the infection (preliminarily or secondarily infected). In the previously studied models [1, ?] the two stains are assumed to be identical with respect to their epidemiological functioning: that is the epidemiological process parameters of the two strains are equal. As a result the mathematical model possesses a mathematical symmetry property. In this talk we study a variant with epidemiological asymmetry between the two strains: the force of infection rates differ for both strains while all other epidemiological parameters are equal [?]. Numerical bifurcation analysis and simulation techniques including Lyapunov exponent calculation will be used to study the long-term dynamical behaviour of the model. The basic reproduction number  $R_0$  threshold will be related to the existence of a transcritical bifurcation. Parameter values used are after [1] which are realistic for dengue fever. For the single-strain system stable endemic equilibria exist and for the two-strain system endemic equilibria, periodic solutions and also chaotic behaviour.

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## References

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