Stability and oscillations in multistage SIS epidemic models

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In this talk we consider a multistage SIS model, where infected individuals are passing through infectious stages $I_1, I_2, \dots I_n$ and then return to the susceptibles. First we calculate the basic reproduction number $\mathcal{R}_0$, and prove that the disease dies out for $\mathcal{R}_0 \leq 1$, while a unique endemic equilibrium exists for $\mathcal{R}_0 > 1$. Our main result is that the stability properties of the endemic equilibrium depends on the number of stages: it is always stable when $n \leq 3$, while for $n > 3$ it can be stable or unstable, depending on the particular choice of the parameters.

[1] Z. Shuai, P. van den Driessche., Global stability of infectious disease models using Lyapunov functions, *SIAM J. Appl. Math.* **73** (4), 1513 − 1532.

[2] A. Berman, R.J. Plemmons, Nonnegative Matrices in the Mathematical Sciences, Academic Press (1970)