

## BACKWARD BIFURCATION, EQUILIBRIUM AND STABILITY PHENOMENA IN A THREE STAGE EXTENDED BRSV EPIDEMIC MODEL

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### ABSTRACT

In this talk we consider the phenomenon of backward bifurcation in epidemic modelling illustrated by an extended model for Bovine Respiratory Syncytial Virus (BRSV) amongst cattle. In its simplest form, backward bifurcation in epidemic models usually implies the existence of two subcritical endemic equilibria for  $R_0 < 1$ , where  $R_0$  is the basic reproductive number, and a unique supercritical endemic equilibrium for  $R_0 > 1$ . In our three-stage extended model we find that more complex bifurcation diagrams are possible.

The talk starts with a review of some of the previous work on backward bifurcation then describes our three-stage model. We give equilibrium and stability results, and also provide some biological motivation for the model being studied. It is shown that backward bifurcation can occur in the three-stage model for small  $b$ , where  $b$  is the common per capita birth and death rate. We are able to classify the possible bifurcation diagrams. Some realistic numerical examples are discussed at the end of the paper, both for  $b$  small and for larger values of  $b$ .