

To whom it may concern

Palaiseau, July 28th 2025

A mathematical model of degree of infection - a case study of mastitis

Agreement with INRAE

Dear colleague,

Thanks for your interest in our work. The set of Matlab® files you have downloaded contain the implementation of a mathematical model of the degree of infection for a case study of mastitis.

The files of the model implementation are:

mDOIload: file to load the experimental data used for the estimation of the model parameters. The data correspond to the individual trajectories of degree of infection of 15 cows obtained from Friggens *et al.*, (2007)¹.

mDOI: function where the ordinary differential equation system is defined.

mDOICost: function to calculate the cost function to be minimized within the parameter estimation routine. It calls the auxiliary functions **load_outputs** and **mDOIerror** to calculate the error of the model with respect to experimental data.

mDOIoptim: function that performs the optimization of the cost function to find the best parameter estimates of the model.

mDOIploty: function to run the simulation of the model. It plots the model outputs for all animals for a given parameter vector by calling the auxiliary function **load_outputs**.

plotcases: function that plots the response of the model for two cases of model calibration. Case 1 is with a specific individual k_p (proliferation rate constant) for each animal, case 2 uses the same k_p for all animals.

¹ Friggens, N.C., M.G.G. Chagunda, M. Bjerring, C. Ridder, S. Højsgaard, and T. Larsen. 2007. Estimating Degree of Mastitis from Time-Series Measurements in Milk: A Test of a Model Based on Lactate Dehydrogenase Measurements. *Journal of Dairy Science* 90:5415–5427. doi:10.3168/JDS.2007-0148.



This model implementation is freely available for academic purposes to foster scientific exchange. The use of the codes for non-academic use is forbidden. By requesting the model implementation, you are accepting that you will not use it with any commercial application or in any work related with companies.

Please feel free to contact us if you have any query about the model. We will do our best to find the time to discuss. If you use our model implementation in your research and publications, please acknowledge our work by citing it.

We hope our model development will be useful for your work. Our main interest of rendering the code available is to favor academic exchange. You are very welcome to contact us to look for potential collaborations.

Sincerely,

On behalf of the authors

RAFAEL MONDZ TAMAYO