

## **Abstract**

In the second half of the 1900s, electric guitars and various forms of distortion pedals became enormously popular and played an important role in determining the sound of light music. The operation of these devices is based on harmonic distortion caused by nonlinear circuit elements. Via the digitalisation of studio technology, the demand for modelling analog devices has been appeared. Thus, in digital environments, the same sound with analog devices can be achieved. Today, this approach has unrivalled popularity, as every personal computer has the required computing capacity to use such modelled digital devices.

The Big Muff Pi distortion pedal was a favorite instrument of many popular musicians in the 70s and 80s. This thesis deals with this distortion pedal's circuit analysis and the creation of its mathematical model based on wiring diagram of the circuit, the characteristics of the elements contained therein and coupling constraint from their interconnection. The theoretical bases for the applied methods can be found in the theoretical summary including the modelling of circuits, the description of linear and nonlinear systems and discretization methods.

For the analysis of circuit LTSpice simulation program has been used. Equations have been arranged in Maple and the model has been developed in Matlab. The analog circuit was also built.

The thesis presents the detailed operation of the circuit, its separation into smaller circuit blocks, its simplification and the creation of a continuous time model based on the wiring diagram of the blocks and the models of the circuit elements and their discretization with implicit and explicit Euler formulas. Each block has been compared to the simulation, and the final version has been selected based on run time parameters and sound fidelity.

The final model has been compared to the real circuit and the Spice simulation. The sound of the model is slightly scratchy compared to the original circuit. The reason for this is supposed to be in the diode model. Compared to the Spice simulation, the model is a little bit blurry, which is caused by linearized transistors in the distortion stages.

The model is not optimized and requires additional work to be carried out to allow real time operation. Furthermore, a more accurate measurement of the circuit elements is required to increase the sound fidelity.