Ziemer Femto Hand Piece Optimization

Lazzaz Zouaoui

Master thesis in Computer Science

This work intends to study the optimization possibilities for the Ziemer Femto Laser Hand Piece, by analyzing 19 M rows from collected data files (traces, initialization, log) of Ziemer Femto machines. It aims to outperform the actual implemented solution limits, particularly the behavioral issues (imperfect path, noise, and vibration); but also to check the pertinence of using some empirical values for the metrics variables, particularly cm5.

The use of theoretical approaches (statistics, machine learning, analysis, logic and graphs) helps to better analyze the parameters in relationship with the issues met, meaning simulations on es- tablished models. For this purpose different clustering (K-Mean and DBScan) beside classification (KNN, Neuronal Network, Decision Tree) methods have been used and compared to identify the potential optimized parameters, which gives a better result. This result will be considered as the optimized solution for the Hand Piece, that should be integrated afterward in the workshop of the Ziemer Femto machines.

To reduce the complexity of the obtained solution, the first graphical user interfaces (Solver GUI) has been implemented. This will help to understand the different steps of the simulation, mainly the computation of the circles from the crowd data, modeling (clustering, classification), and the optimization search. The second graphical user interface (eXtended GUI) is implemented to update the Hand Piece with the optimized parameters of the solution.

The actual study shows that an optimized solution is possible using a combination of several met- rics parameters different than cm5.

This work is limited to the circle metrics, and is considered as a proof of concept submission.

Prof. Philippe Cudré-Mauroux

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