

# Geometrical Modelling for an Automated Faceting Machine

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## Abstract

Usually, the faceting of precious stones and jewels is manually done by professional and specialized craftsmen. It is a laborous task and such professionals are hard to find. Therefore the manual production of gemstones takes a lot of time and doesn't guarantee a high precision on the results.

To supply an increasing demand for lapidated precious stones, we are developing an automated faceting machine. Our main goals for it are precision, repetibility, and speed. The first one is required such that we achieve higher quality than manually crated gemstones, while repetibility is important to provide almost identical jewels. Finally, speed is also important because the need for large scale production.

This machine takes part of an development project, in current progress at UNIVATES University Center. The first machine prototype has been built by RW Company, technical partner of this project. The machine is supposed to lapidate semi-precious stones (gems) by fixing them in proper positions and angles against a diamond cutting disc. The gems come pre-cut, in adequate size, needing only cutting of small parts in order to shape them in standard or new lapidation formats, like making 10, 20, facettes in a gem of, lets say, 10 mm diameter. The facettes are done usually on both side of the gems, so gems are attached to a fixture, lapidated in one side, transfered to another fixture and then lapidated on the other side. The same machine does the cutting (lapidation) and polishing, with the same mechanism, but changing the disc.

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For the automation, we are using stepper motors for positioning, with 1.8 degrees/step, or using half step, 0.9 deg/stp. We used a linear modelling, by numerical control. Right now we don't have any feedback of the real position of the head holding the gem. So a precise geometrical modelling of the gemstone needs to be created to drive the machine motors in the lapidating process.

The related problem involves the geometric definition of the facets in the same sequence in that they would be made manually. In fact, we just obtained the solution for some particular cases of classic drawings of stonegems.

As future actions, we intend to improve the machine, by using a laser sensor mounted atop the head for measuring the real position of the gem in relation to the disc, obtaining then a resolution around 10-20 microns, by position servants, using an PID (Proportional, Integral Derivative) algorithm. Furthermore, we need generalize the modelling scheme of lapidating.

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