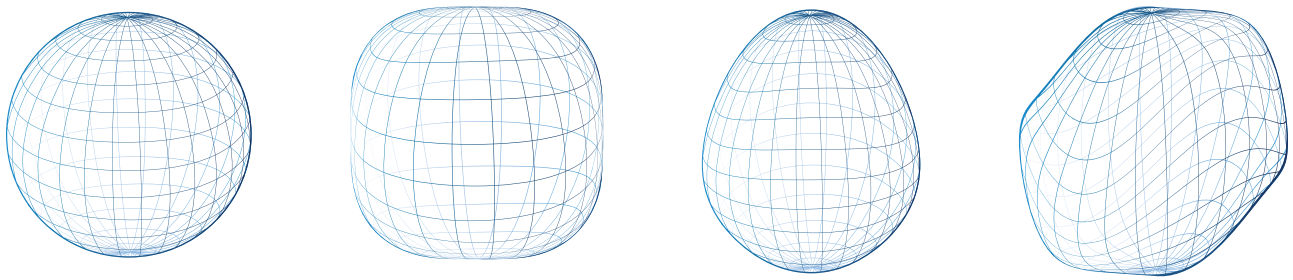
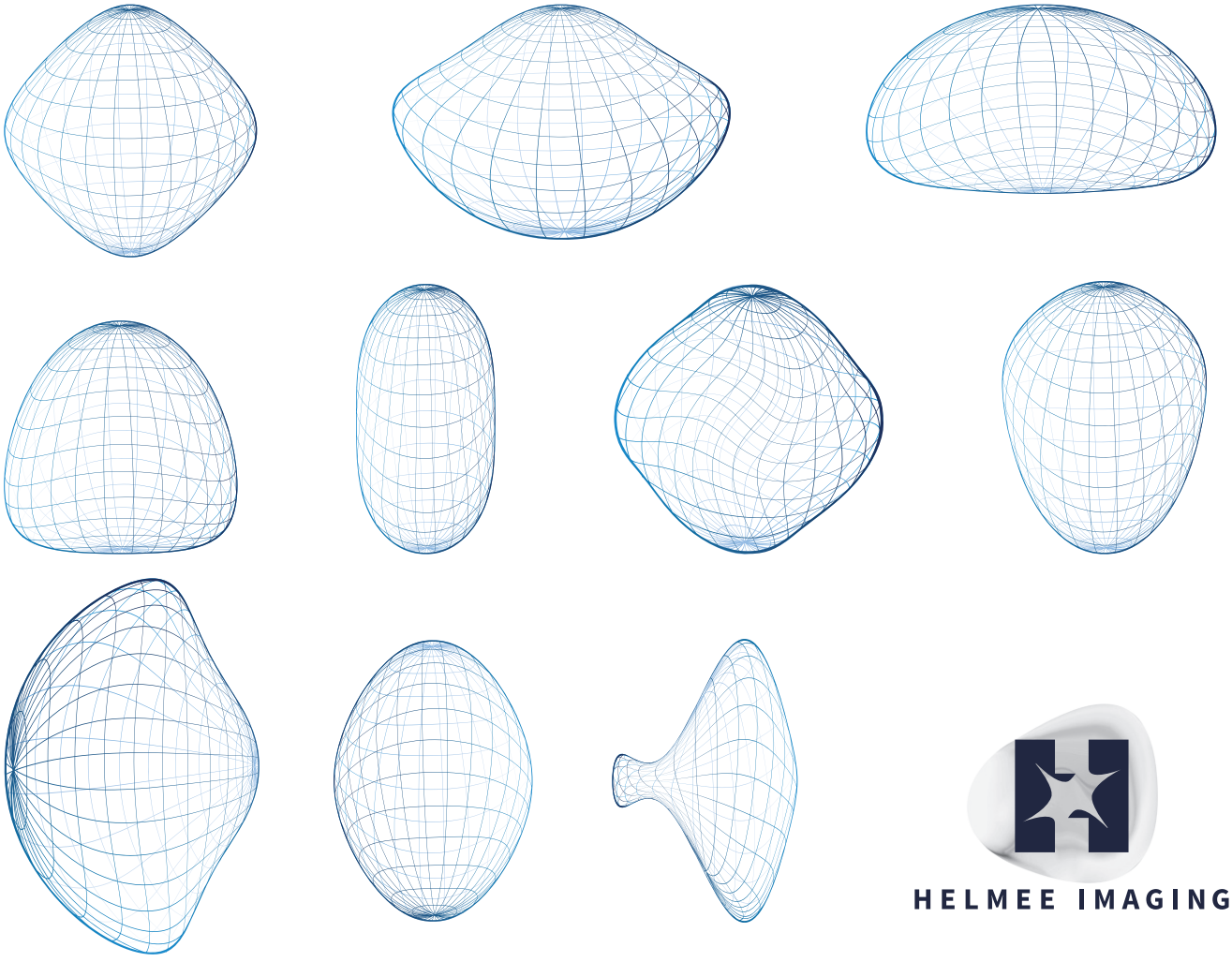


WHITE PAPER BY HELMEE IMAGING – 2016

The future of quality inspection

PERFECTING THE FUTURE



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Quality, what is quality and how it is measured?

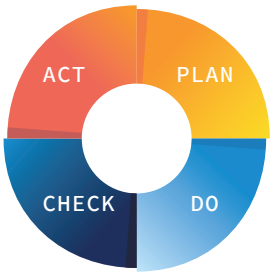
According to Wikipedia quality management is about to improve the features of goods and acts and controlling the deviation related. (Wikipedia: Laatu) There are different definitions to quality also presented in Wikipedia. When defining the quality there are various possible approaches. Regardless of the approach quality should be somehow numerated. That is done to have measurable criteria and classification for common understanding between people what is quality. (Figure 1)

FIGURE 1

Simple quality classification based on some measurable criteria.

Measuring quality is done to give background information for improvement. Due to competition at market, there is continuous need to improve goods or service. People minds are such that there must be some measurable way to describe the product or service feature in order to improve it. Abstract things are really difficult to improve. Those are often experienced differently by people – gut feeling is not necessarily the same for all. Thus there are numeration and detailed descriptions for criteria behind the quality to ensure common understanding. Also because of that numeration machines can be set to measure quality. Numeration makes the quality measurable and once you have the numbers, you can analyse them and then improve. (Figure 2)

FIGURE 2



Classic example of quality process in general.

Quality is measured differently depending on the measurement target and what is critical for customer or end user. If service quality is measured that is often done just by asking the experience of people being served, yet still in a given simple numeric classification. For products there are usually clear measurable features e.g. length, weight, width, humidity, thickness, shape etc. Those are then compared to given criteria or allowed variation. If the limits are crossed the product is rejected and not let into customer delivery. There are products that have features difficult for machines to estimate and then the quality inspection and control is done by human. Those can be e.g. features of surface. This is especially in the case of glossy or shiny, mirror like surface. They are typically produced with some coating or plating, like chrome for example. Traditionally those kind of surfaces are extremely hard for machines to estimate if that surface is good quality or bad. This white paper is limited into that traditionally difficult area – glossy surface quality inspection and control.

Manual inspection

Most often today the quality inspection is done manually (Figure 3). Simply described, human workers are looking at the parts produced and estimate based on look and feel if the part is acceptable

FIGURE 3

Examples of manual quality inspection of glossy parts and ceramics.

or unacceptable according to the educated criteria. Shiny surface and bright lights is difficult situation for eye due to stress caused by reflection from the parts. There are some benefits in this procedure:

- Human is good at finding exceptions
- If the inspected parts changes to some other part, the change is easily adapted for quality workers
- You do not need too much education for this monotonic task, that is there are a lot of work force available

There are however also negative sides in the task:

- Slow deviation in quality is not easily noted by human inspection
- Cycle time is not matching with automated production line, people are too slow
- Physical facts like blind spot in the eye are limiting the capability
- Work is very monotonic, that is many people are not willing to do it and also it has an effect to inspection procedure
- Where is no standard as the quality inspection and decision is based on a single human opinion, that is some parts may be acceptable for some worker but another worker may judge those unacceptable and both may have variation on their opinion on day to day

Now it is good to notice that one goal in quality management according to Wikipedia is to control the harmful deviation. This exact point is the weak link in human quality inspection process – there is a lot deviation in sorting i.e. judging if a part or product is acceptable or unacceptable. Still however, manual inspection is the most commonly used process related to glossy surface parts. That is so because previously there has not been automation available for this demanding task. In terms of deviation, picture yourself in the factory, next to conveyor belt, you have 6 seconds to inspect the quality of some part that needs to be inspected from different angles due to your blind spot in eye, all three surfaces that are meaningful must be inspected giving you 2 secs per surface and you should find if there is a defect in coating. Six different defect types and smallest defect about 0,1mm. Think there is going to be false judgements and variation in sorting criteria during the 8-hour daily shift, or one week, month?

Automation in quality inspection

Currently there are automated quality inspection in many cases. Some of them utilize cameras, some lights, many of the utilize both and other technical inspection methods. So far those have all failed however in the case of glossy surface and curved shape. There is equipment available that can automatically measure e.g. thickness of the plating or coating. That is not good enough. There is equipment available that can measure nicely defects on a 2D-surface. There are too many parts that are actually far away from 2D. Based on this background it is commonly known that there is huge demand on automated quality inspection of glossy surfaced mass products.

Production processes

Production processes are getting more and more automated. There are not many parts in the process in e.g. chrome plating which is not automated. Automation is done for increasing capacity and speed of the production but also in order to avoid deviation in quality. Car manufacturing has been traditionally forerunner in utilizing automation and robots in production facilities. Many of the chrome plated parts are actually supplied for this industry giving a great demand in volumes but also in quality. Car manufacturers give relatively tight standards for quality, what is accepted and what is not. In some case it is really hard to meet these standards in manual quality control executed by human.

If a car industry supplier produces large volume of chrome plated parts, the quality control is easily a bottle neck in the process. That is especially if the other parts of the process are modern automated and robotized manufacturing. People just are not that fast as machines, especially when you must sort bad and good quality separately in fast pace. There must be several people working on the production line for this simple monotonic task with only couple of seconds per part. This is the weak point of these highly controlled and complex facilities.

One major thing in the output of the quality inspection is the reporting. How many defects and what kind of defects. This is important to know for plant manager or production chief – how else they would know what needs to be improved in terms of quality unless someone reports it. Who is making the report and how it is done if the quality inspector has only couple of seconds to spend with a single part? That is the reporting is either not just done, or there is not too much weight on it. Reporting is not detailed if the quality control is done manually and the speed of production has been on focus point when planning the process.

Adding automated quality control

The cause of manual quality inspection is significant. The inspection as a process is slow, it has a lot of deviation in output, there are big lacks in reporting, cost is great due to several people needed but also due to misjudgement in inspection and the yield from production is not at the level it could be.

By adding automation also into quality inspection all abovementioned issues can be tackled. What is even more beneficial is that there can be LIVE-monitoring in place. This means fast reaction if there is some defect that keeps on repeating. This leads into better yield of the whole production and also prevents deliveries with defect parts. The defects are found closer to manufacturing or coating line making it cheaper to fix the issues. Probably one of the biggest thing is the standardization of quality. The deviation in automated quality inspection is a feature that can be tuned according to customer requirements. The acceptance level can be set to match those requirements, exactly. When machine has the criteria, it keeps on following the criteria without deviation regardless of the time of a day or month and mother in law.

The next big thing in quality control of glossy products

Covered Stereo Deflectometry (CSD) is a registered trademark of Helmee Imaging. It really is a technology that will revolutionize the quality inspection of glossy surfaced products with any shape. Now it is possible to add automation also in quality inspection of chrome plating or shiny surface mass product production line. This technology enables you all the advantages of automation. In the field of chrome plated parts there is a great need for this kind of technology:

- Traditionally there has not been any automated quality inspection or control tools available
- Many of the products are produced in great volumes, humans are the bottle neck in quality inspection
- Glossy surface products do not meet all the requirements given by e.g. car industry

There are a lot of automation in other parts of the manufacturing but these kind of new technologies enable totally new era of production also in glossy surfaced parts, whether those are chrome plated or PVD coated etc. It is a huge benefit for manufacturers who have already adopted this into their production as they will get the reporting and thus straight receipt what to do in order to improve their production. Also from customer point of view: if some factory gives you even 1000 times more accurate quality with accurate inspection report and lower cost, who would you choose?

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