An Internet Based Surface Texture Analysis System

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1.0 Introduction

In recent years, large companies have moved away from manufacturing all the parts that are needed for the product they market. Instead of in house manufacturing, they are resorting to outsourcing of parts. The companies that manufacture the parts tend to be small and in many cases lack the metrology and process expertise needed to trouble shoot problems related to part quality and part variability. The large companies that design and build the products are still responsible for the quality and performance of the parts and therefore work with their vendors to ensure process capability and reduce part variability. Since the manufacturing processes are geographically separated from the large companies there is a need for remote access of data and ability to analyze and trouble shoot processes. This project addresses this need by developing an Internet based surface texture analysis system with database support. This paper deals with the development of the basic infrastructure to undertake remote process studies to reduce process variability and to accumulate process knowledge.

2.0 Internet Based Surface Texture Analysis

This project offers a unique way to analyze surface texture. It provides a repository for surfaces through a database, a set of tools for surface texture analysis, remote access to both data and analysis tools. The analysis program and the database program are accessible through a web browser with an Internet connection.

The analysis system is designed using object oriented programming technique. The main components of the system are the user interface classes and the background processing classes. All the classes of the system has been developed using Java (JDK 1.1) which is the de facto language of the web. Since this is an infrastructure project that will evolve in different directions, care has been taken to make the design to be robust and reusable. In developing the software an incremental approach towards gathering requirements, designing the software, and implementing and testing it was taken. This approach was taken so that the requirements could be modified to increase the scope after an iteration of the development cycle. This approach was also essential due to the lack of precedents in similar number crunching applications on the web.

2.1 Surface Characterization

The main features of the software include a database into which a user can insert measured data, query for specific datasets, and/or select specific datasets for analysis [1]. The software provides analysis tools that are available on the measuring instruments and then goes beyond by providing flexibility. It also provides advanced tools such as power spectral analysis, correlation, and wavelet analysis that are not available in current analysis systems. The ability to access data from a database of profiles is an important function of the software. This provides a way to understand

the parameters involved in the process. Two surfaces can have the same R_a but one might perform better than the other one. This is a common problem that is encountered. The "Compare Two Profiles" function of the software addresses this issue. The "Generating turned profiles" function gives the user a way to compare a theoretically generated profile with the actually produced surface. The "Asperity removal" [3] function removes asperities from the surface and gives statistics on them. This saves time, as the user need not measure the part again when the asperity is caused due to debris. This function also allows the user to analyze porous surfaces. Analyzing multiple files at the same time is a unique tool that is not offered by current analysis systems. This allows the user to analyze surfaces that have been generated at different times by the same tool. This is useful in monitoring for tool wear. Analyzing a surface at multiple cutoffs is another function that is provided by the software. Figure 1.0 shows the compare two surfaces function of the software. The figure shows the comparison of two plateau-honed surfaces.

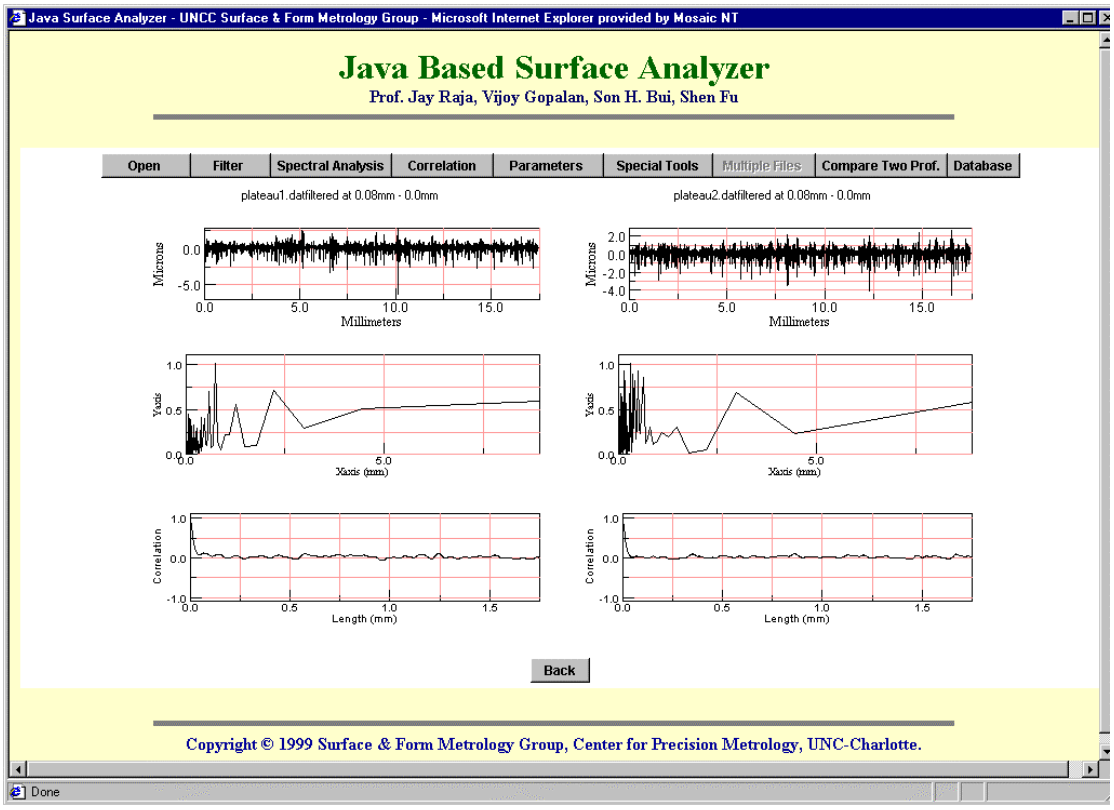

Figure 1.0 Comparison of two plateau-honed surfaces

2.2 Database

The database is used to organize the information of how the surfaces are produced [2]. Parameters of machine condition, cutting condition and other process parameters can be stored

along with the part information. In addition, the database is used to store data generated from surface finish instruments. With this database, a metrologist can quickly query information through the Web and use it to develop process knowledge and find the trends that cause process variability. The database provides features for querying information based on parameters, instrument name, process, filename, part name, time and date. It also provides tools for visualizing the information after doing the query. Tools for loading the data sets for analysis are also provided.

Each user is provided with separate account. The user can login to his account and can insert data into the database from his local disk or any other remote location. The user can also delete data sets that he had previously inserted. Figure 1.2 shows the output of a query for all data that have P_a less than 0.5 µm.

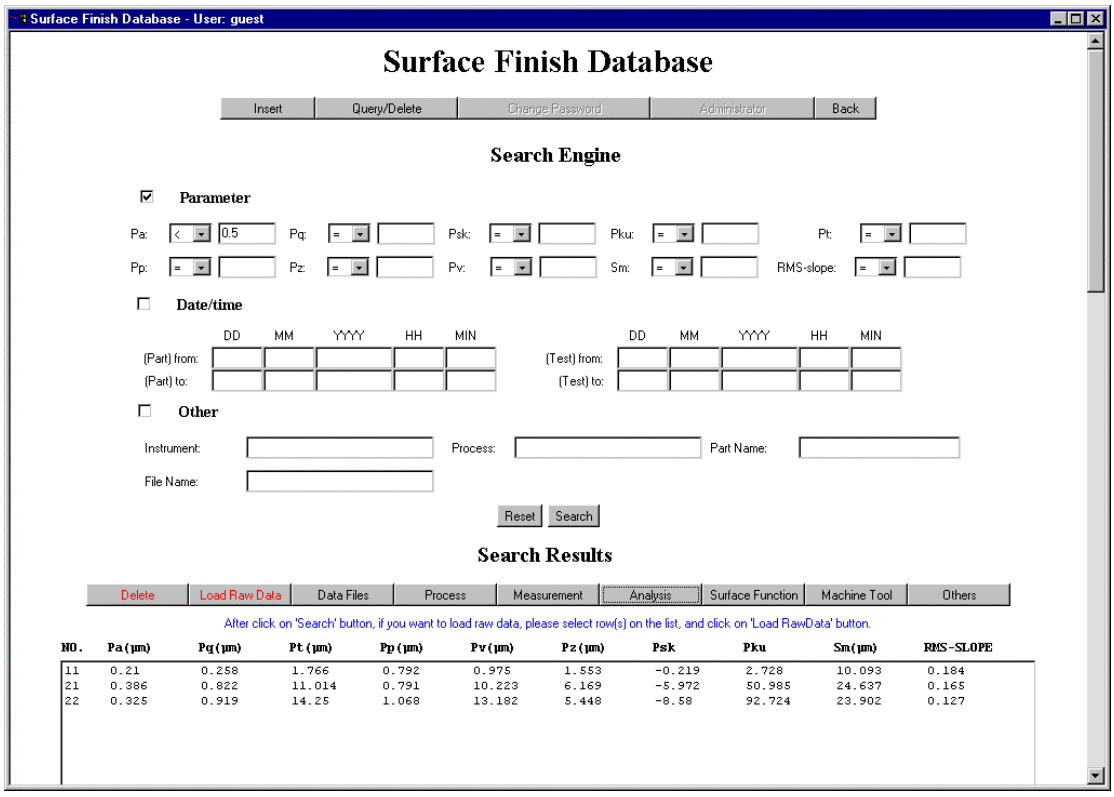

Figure 1.2 The result of a query from the database (P_a<0.5µm)

3.0 Conclusion

Internet based surface texture analysis offers a new way of analyzing surfaces. It offers advanced tools, along with a repository for surface metrology data and process information through a database. This harnesses the power of the computer to collect and store large datasets over a

sufficient time to make a cause and effect analysis between surface finish and function on the one hand and surface finish and the manufacturing process on the other. Using the work done so far as a foundation, a method for remote measurement can be visualized. An instrument in a laboratory/remote factory (location B) can be made as a server, and using web casting techniques, and the available tools on the web a person in location A can *measure and analyze* surfaces in location B and discuss the results with a person in location C. This type of system permits large companies to trouble shoot processes remotely by assembling the appropriate experts. The field testing of the software tools is currently being initiated and the results will be reported in the future.

4.0 References

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