

Micro Nano “PMP” (Product-Method-Process) Graduate Course

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I. INTRODUCTION

The design and manufacture of micro and nano products or systems is considered to be a very difficult and challenging task. The manufacturing technologies used to produce them are either emerging or pushed to the limits of their capabilities [1]. The physical working principles or design solutions are often not in the same area as common engineering. Moreover, very little of this knowledge is available outside of the research and development context. Moreover the very nature of micro products induce a very collaborative and multidisciplinary way of working [2]. All of these concepts require specific research and teaching activities.

II. MICRO / NANO PRODUCTS SPECIFICITIES

One major issue is the multidisciplinary community involved in the development process of micro / nano products. It induces communication problems and also knowledge related topics. Indeed, manufacturing knowledge is reckoned to be extensively used all along the design process, although it is especially not stable nor mature.

Another major issue in the development of micro products is their integration with the external world and how to make them fit inside macro scale products. Packaging for micro products includes electric connections and protection of the systems (as in VLSI chips) but the interface is mainly required to achieve a specific functionality.

III. RESEARCH

From a research point of view, products are investigated such as interactive optical display for Bang & Olufsen hi-fi systems [3]. A study on the comparison of a product driven approach vs technology push approach in the design of a superhydrophobic surface using biomimeticism from the lotus effect [4] is conducted, it includes metrology and surface engineering issues. On the process side, replication techniques for mass production such as micro injection moulding [5] require tooling and therefore various manufacturing technologies are investigated: micro milling [6], laser processing, micro EDM...

IV. EDUCATION

From an education point of view, specific courses have to be set up, to build a new knowledge corpus and develop new skills, including projects and teamwork. This as already been studied both in macro scale mechanical design and in pedagogical science. Therefore, our teaching choices have been focused toward multidisciplinary. The course plan is innovative as it focuses equally on methods, various manufacturing techniques and specific micro mechanical systems issues from the product functionalities side. Be-

sides to lectures, exercises and practical works, an industry-like project is designed in order to give students an overview of a complete development process. A new vision of the micro / nano product development scheme will be presented. A full time project for students will be described within in the field of innovative technologies. The complete course will then be described, focusing on how to give students the necessary knowledge to achieve the complete product development and do actual manufacturing (see fig.1).

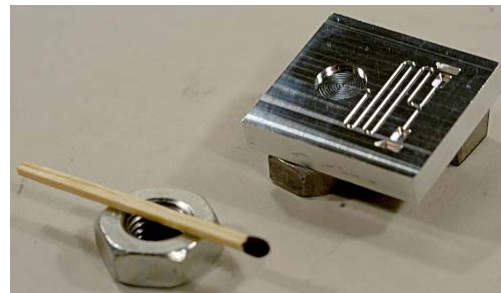
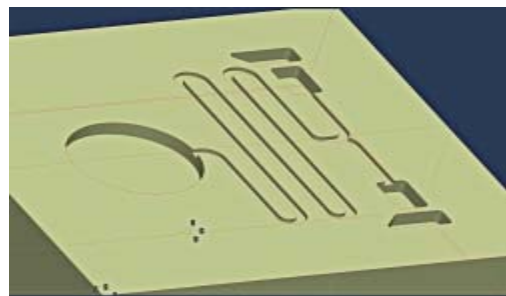


Fig.1 CAD file and machined part of the design of a micro fluidic system for the student project. (channels are 600 μ m in width and 300 μ m in depth)

V. CONCLUSION

A graduate course in the field of micro / nano mechanical products has been presented. The course is closely linked to industrial reality and to the key technologies within the field. Moreover, a specific innovative way of teaching it through products, methods and manufacturing techniques (PMP) is developed, applied also in research activities.

VI. REFERENCES

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