

The power of sensors

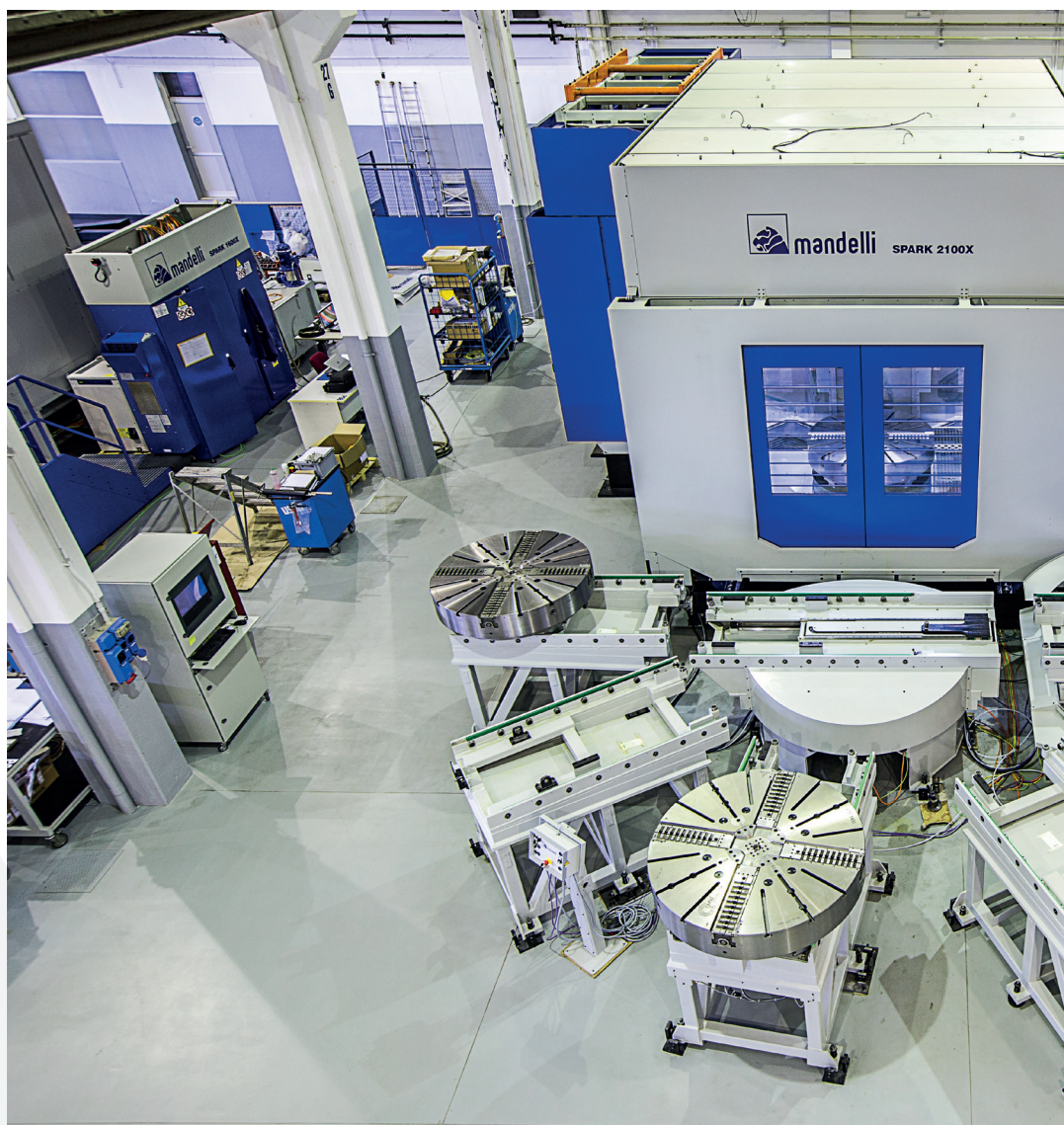
Sensorization of machining centers, connection, data analysis for the improvement of production processes: this is the way Mandelli Sistemi intends to bring its customers to the world of Industry of 4.0.

by the editorial staff

A key concept of the fourth industrial revolution - machine digitization - is that the acquisition of process data generated by an industrial plant has now become a key tool for more profitable management of production facilities. The growing sensorization of the machines now made possible by the high technological level of the devices on the market and the big steps taken by the telecommunications industry and transmission systems allow for efficient remote access to process data so that they can then be used within a more complex system made of SW and management applications, capable of analyzing and processing multiple information, deploying it to various departments so as to put all the operators in the right conditions to make the most suitable choices for the production process, a key issue for all manufacturing sectors.

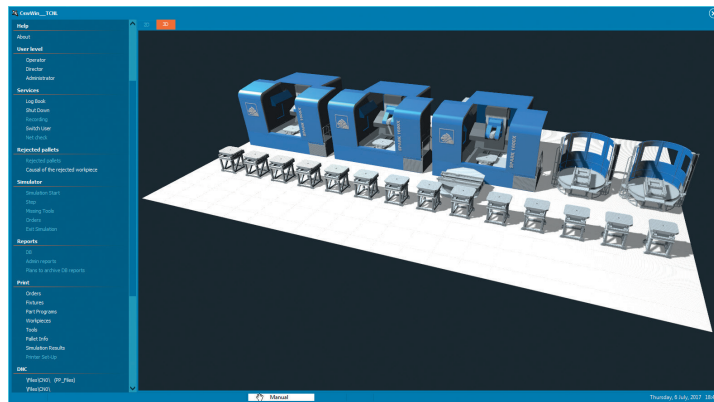
INFORMATION AT WORK

It is in this scenario that Mandelli started the iPum @ project which was born out of the idea of offering an efficient predictive maintenance service to customers. Conceived already in the early 2000s but made possible today thanks to the new technologies concerning data collection, sharing and analysis, the very core of iPum @ Suite 4.0 is a set of products and services that integrates all data collection, process and management that provide a complete view of the HMC workflow





and operation both to the customer and manufacturer without affecting the privacy associated with the customer's manufacturing and production cycles. Through a sort of continuous check-up of the HMC it is possible to assess the HMC "health status" in real time in any operational condition by continuously verifying the actual wear to which some important components are subject (spindle and axes are the areas that are under greater control), to have a basic information framework useful to design more efficient future solutions and to check the correctness of the production process which is always aimed at maximizing the result thus avoiding the possible presence of harmful vibrations for the machinery and for the part

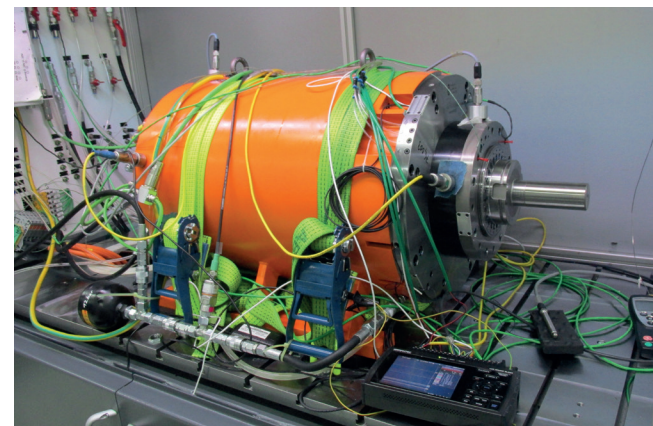


Left : a screenshot of the iScada 3D SW
Below : the sensorized spindle with which Mandelli machines are equipped



in production. Last but not least, the ability to service only when needed, anticipating breakdowns to minimize the HMC downtime to recover at least 3 to 4% of the system efficiency. An apparently limited value which however ensures an interesting increase in competitiveness in a mature market where the return expected by customers exceeds 95%.

The iPum @ Suite 4.0 package consists of 5 independent modules: iControl is the new operator panel, the 22 "touch screen man / machine interface ergonomically designed for instant and intuitive experience where the control ensures the networked machines to be monitored remotely via PC, Tablet or Smartphone. Increased reality Apps are the basis of iReality, especially designed for the maintenance operator, which makes it easy to diagnose and correct any malfunctioning



in the HMC. The widespread sensorization of the HMC main components enriches via cloud a database of information that, through the iPredict statistical calculation software, forecasts a future machine stop so as to plan a maintenance intervention with

Opening : the large number of sensors on mandelli machines allows for great advantages in terms of IoT

Below left : iPredict can forecast a possible machine stoppage

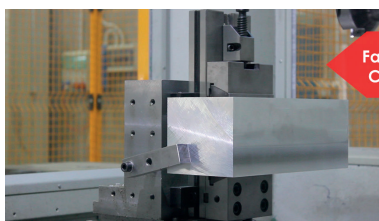
Below right : iControl is the new operator panel with a 22" touch screen monitor



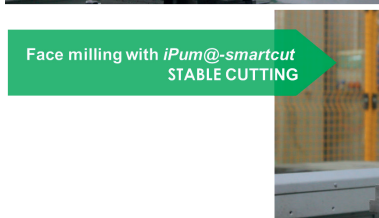
the least impact on the production system and only if necessary. An intelligent vibration control system called iSmartcut detects any anomalies in the milling / turning operations in progress and optimizes the working parameters to ensure a smooth execution and a high quality finishing. Lastly iScada, where Mandelli's long-lasting experience in flexible cells has been fully deployed, which is the new, powerful FMS plant management system, the first on the market with a new full 3D graphics that allows for a quicker and more intuitive monitoring of complex systems.

APPLIED SEARCH

To better understand the importance of Mandelli's choice in terms of intelligent automation, we are pleased to quote an application on one of the vital parts of an HMC, namely the electro-spindle: through the important collaboration with KESSLER, Mandelli's reference partner, a new generation of electro-spindles has been developed where sensors play a primary role in comparison to previous models. Along with the classic temperature sensors on all the bearings, the head behavior is also monitored by the use of vibration sensors and accelerometers capable of measuring vibrations in all three directions X, Y and Z. The data generated by these sensors are then processed in an evolved way by one of the packages that make the iPum@Suite 4.0 package in order to recognize in real-time the machining anomalies through vibration monitoring and then modify the processing parameters so as to stabilize the process in progress. This is a highly sensitive system



Face milling without iPum@-smartcut
CHATTER: high vibration & high noise



Face milling with iPum@-smartcut
STABLE CUTTING

The difference in the surface quality which can be obtained with iSmartcut

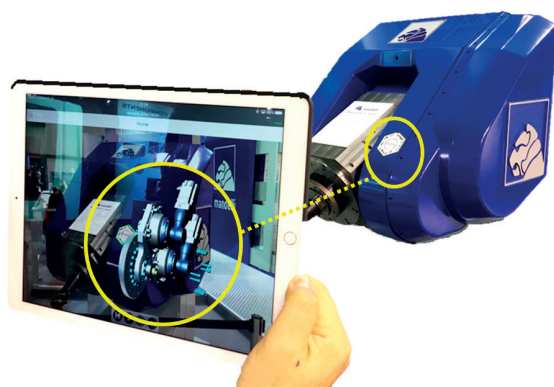
MANDELLI HAS RECENTLY BEEN AWARDED THE INNOVATION PRIZE AT THE SMAU FAIR AND WON AN IMPORTANT ANNOUNCEMENT OF THE MINISTRY OF ECONOMIC DEVELOPMENT

that can even analyze any micro-vibration which is not relevant for the HMC condition but sufficient to assess the quality of the workpiece surface and determine whether it can meet the customer's expectations or whether it will be necessary to take any corrective actions to bring the piece back to the desired quality standard.

Already within the modern numerical controls it is possible to have a wide range of position, speed, axle acceleration and engine temperature information but there are other significant data that Mandelli intends to get from its machines. Hence the collaboration with subsystem suppliers such as, besides the electro-spindles, the ball screws and roller slideways suppliers to sensorize these parts as well since Mandelli is already carrying out important tests by putting them under accelerated wear conditions to evaluate how information from sensors changes with the changing of the operating life. Lastly, it is also interesting to apply the turning table monitoring sensors to the Mandelli multitasking machines and their clamping systems in order to balance any eccentric load and verify that the workpiece clamping is correct. This is because the table/work-piece system

can rotate over 600 revolutions per minute and if the set is not perfectly balanced there can be consequences in terms of machine safety, work-piece precision, and bearing life cycle.

These issues are proving to be very interesting in particular with large and structured companies because there is greater awareness and understanding that these tools can improve the efficiency of their production to maximize results. Also at industrial research level, the iPum@Suite4.0 project is gaining approval: Mandelli has recently been awarded the Innovation Prize at the SMAU fair and won an important announcement of the Ministry of Economic Development, where digitization plays an important part along with the technologies for the processing of tenacious materials.



iReality offers an "augmented" view of the HMC operating conditions