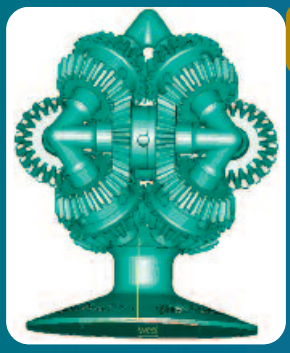
Photo essay

Materials

Analysis and modelling

Cover story – continued

The introduction of shape memory alloys resulted also in improvement of the technical level of the medical equipment. Such examples may be the design changes of the artificial heart or miniaturisation of the dialysis pumps. The contemporary applications of the shape memory alloys include also needles for breast tumour localisation, cores of guiding wires, stretchers used, e.g., as implants for distending the veins as a specific kind of a stent, surgical instruments and adaptive endoscopes with the shape adjusting to the patient's anatomical features during the operation or examination. Apart from the applications mentioned above, many new shape memory alloys application areas are found or are currently implemented. One may include to them applications in astronautics and aviation, due to significant adaptive capacity in zero gravity conditions. Therefore, these materials can be used for the self-deploying antennae, for operating the solar batteries shields, for reduction of vibrations and for joining pipes in spaceships, and for airplane wings geometry changes. In the automotive industry, apart from the pressure valves, these materials can be used for vibration attenuating pads and for devices switching the cooling or air-conditioning systems. These alloys can be used for the airtight closing of the industrial waste containers flaps should they set on fire, in the vibration damping devices in civil engineering, to prevent sagging of the electrical energy transmission lines, to compress the transformer cores, and also for plotter pen tips, in the air-conditioning valves and heater valves in flats and in the industrial premises, and also for the mobile phones self-deploying antennae with the required high gain. Next attempts will come, undoubtedly, to use this material group, which poses more and more demanding requirements pertaining to their design and technology. An example of such activities are the research and development projects dedicated to working out materials demonstrating shape memory at temperature higher than to date, investigations of the magnetic shape memory, and also using these materials as matrix or reinforcement in composite materials. Due to the need to use shape memory metal alloys, among others, in the automotive industry, in refineries, and in protection equipment, it is necessary to search for alloys with the higher than to date temperature Af of the finish of the reverse transformation of martensite into austenite, which – for the alloys presented so far does not exceed 120°C. Employment of shape memory alloys with a higher temperature Af makes the increase of the material cooling rate and of the frequency of changes possible which is connected with the increase of the service frequency. In some materials big deformation reaching 8% may occur under the influence of the external magnetic field. The phenomenon, called the magnetic shape memory is connected with reorientation of martensite due to the movement of the twin boundaries between the particular martensite types under the influence of the magnetic field. The movement of the magnetic domains walls occurring due to magnetization causes the movement of domains in the structure. The strongest magnetic shape memory effect occurs in Heusler's alloy with the approximate chemical composition Ni_2MnGa, alloys Fe-Pt, Fe-Pd, and $FeNi_{31,9}Co_{8,9}Ti_{4,1}$.
Currently the magnetostriction materials are flourishing albeit the magnetostriction effect was discovered by J.P. Joule only in 1842. They have found many applications, among others in seismic sensors, geological tomography, in sonars, movement, load, and magnetic field sensors, variable geometry mirrors, fuel injections systems and hydraulic valves, industrial cleaning systems and other devices which do not have to be of miniature sizes. Such materials may be also used in aircrafts to actuate wing geometry changes depending on flight speed, for vibration attenuation devices in aircrafts, for surgical instruments or acoustic devices, and also in systems monitoring condition of elements made from composite materials in service. As the new magnetostriction materials are developed the range of their applications grows and there are more applications of such materials in the industrial control and automation systems.
Other smart materials include the piezoelectric materials, electrostriction, electro- and magnetorheological (liquids), electrochromical, fibre optic and chiral ones (optically active), and tunable dielectrics. Among the smart materials there are metal materials, ceramic, polymer, and composite ones, and this group grows rapidly. Therefore, we invite the Authors to publish their scientific contributions from this area in our journal.



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The analysis and modelling area section represented by B. Valentan, T. Brajlih, I. Drstvensek, and J. Balic on "Basic solutions on shape complexity evaluation of STL data" on a **page 73** presents a few methods of mathematically evaluating the complexity of the shape. Methods vary from very simple based on the number of triangles in STL file, STL file size and the parts volume, to the more complex mathematical evaluation based on the basic relations of the STL data. In a rapidly developing field of manufacturing technologies choosing the optimal manufacturing procedure is a difficult and crucial decision. The decision is usually based on experience evaluation that is fast and can be optimal. Therefore, it is crucial, that a fast and simple solution is developed, by which the optimal way of manufacturing can be determined. Choosing maximum efficient manufacturing processes on the basis of part complexity is a new perspective in manufacturing, which, properly evolved and complied can cause revolution in manufacturing optimisation, especially in hybrid manufacturing processes.

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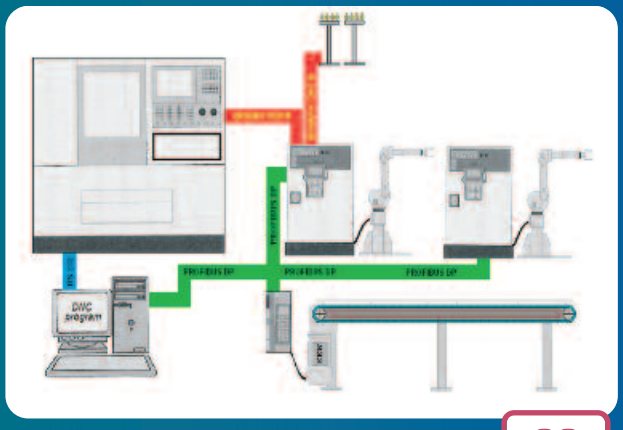
The Manufacturing and processing section represented by B. Mursec, P. Vindis, M. Janzekovic, F. Cus and M. Brus on "Testing of quality of sowing by pneumatic sowing machines" on a **page 81** shows that in order to sow it is necessary to know adequacy of the soil for sowing, technical properties of the sowing machine and biotechnical characteristics of the seed. Cultivation of sugar beet depends primarily on expert and technically correct sowing. For growth and normal development of plants the distance between seeds in the sowing row is the most important parameter. Expertly performed sowing and sowing machines are of great importance for cultivation of sugar beet. The tests were aimed at defining the most suitable sowing speed for both sowing machines on the basis of measured data. The principal aim of the paper is to establish whether the higher working speed influences the quality of sowing. It is very important for the producers to be well familiarised with all agrotechnical measures because cultivation of sugar beet requires much money invested and work performed per unit of area.



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The paper entitled "The signal connections in robot integrated manufacturing systems" by D. Reclik, G. Kost and J. Świder on a **page 89** demonstrates that the robot integrated manufacturing systems are more popular and useful in the industry. Moreover, the communication in those systems might be realised by many different data exchange solutions. Using this kind of solution causes the data exchange incompatibility. This paper deals with different ways in informatics connection of all of the components in the robot integrated manufacturing system. Incompatibility is a result of usage many different communication systems between components in the lathe centre. The way of mutual signal connections were the target of researches. The result of the researches developed a technical element choice procedure of the data exchange depending on transport means quantity and system composition in the robot lathe system. This paper describes internal systems of data exchange in the robot integrated manufacturing system in an example of the automatic lathe centre.