Introduction

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Biographical notes: Francesco Sorge has undertaken scientific and educational activity in the University of Palermo, Department of Mechanics. He is a full professor of applied mechanics and a teacher of theoretical and applied mechanics and mechanical vibrations. His research interests are in the areas of mechanisms, vibrations, lubrication, ferrohydrodynamics, turbomachinery, power transmission, belt mechanics and railcar dynamics. He has presented several scientific papers at international conferences and had papers published in many international journals.

Marco Cammalleri graduated in Mechanical Engineering with full marks in 1998 at the University of Palermo. He has been assistant professor since July 2000 and teacher of mechanics of the machines since 2001 at the University of Palermo. He is responsible for the mechanical transmission laboratory at the Department of Mechanics of the University of Palermo where he carries out theoretical and experimental research on continuously variable transmissions, single and split way. In the CVT field he keeps in contact with other researchers, attends international congresses and is author of several scientific papers published in international journals.

A fundamental intermediary interconnects the power source with output in most mechanical systems: the driveline. The task of pursuing the best efficiency and/or the most brilliant performance in this energy transfer is assigned to the engineers and researchers in the field of power transmissions. Several new solutions were conceived and realised in previous decades with the aim being a better match between prime mover characteristics and utilisation demands, together with a reduction in overall power losses. Each small progress towards these objectives contributes to the improvement of energy management in machinery and, as a final consequence, to the amelioration of quality of life in the long term.

A prominent position in this panorama is occupied by belt drives and continuously variable transmissions (CVT), which are currently focusing the interest of an increasing number of researchers and technicians. The chief advantages of CVTs, in comparison with the other conventional transmissions, are the finer fit obtainable between the most efficient working condition of the driving motor and the requirements at the output of the machine in terms of torque and speed because of the relative ease in adapting the speed ratio to the various

conditions. At present, composite metal belts consisting of tension bands and compression blocks permit the application of the CVT conception to motor vehicles even of the mid-high power class.

Belt drives also play an essential role in implementing power distribution towards automotive engine accessories by multi-pulley systems. Here, the main goals are correct synchronism with the drive shaft and the damping of the oscillatory motion excited by the engine torque or by other disturbances. These requirements lead to the use of timing belt-sprocket couplings and serpentine belt drives equipped with tensioners and isolator devices.

This joint special issue of *International Journal of Vehicle Design* and *International Journal of Powertrain* gathers a collection of high quality contributions from engineers and scientists working all over the world in the area of belt or chain systems of all types, timing belts and CVT, with special regard to vehicle application. These contributions are shortly summarised below.

- The best control strategy for automotive CVTs can be achieved through the hydraulic-electronic regulation of the primary and secondary actuator pressures. Ryu, Nam and Kim propose a new control algorithm for a CVT using a pressure control solenoidal valve.
- Metal V-belt mechanics is strongly affected by the elastic deformation of the belt and the pulley plates. A variational approach is presented by Sorge, which identifies the pulley bending deflection by the principle of virtual work.
- The problem of reducing vibrations in the automotive front end accessory drives is studied in depth by Balaji and Mockensturm, focusing multi-pulley systems where isolators and/or decouplers are installed on the highest inertia elements.
- Bonsen, Klaassen, Pulles, Simons, Steinbuch and Veenhuizen describe an extensive theoretical-experimental work on their optimised slip control technique for metal V-belt CVTs, which aims to minimise the clamping force in every working condition and improving efficiency.
- The stability behaviour of zero-inertia continuously variable drives, equipped with flywheels and epicyclic gears, is analysed by Vijlbrief, Serrarens and Steinbuch by means of advanced mathematical tools.
- Finally, a new finite element code is presented by Leamy and Wasfy for the study of the transient and vibratory behaviour of automotive accessory drives, particularly analysing the responses to prescribed inputs and the frequency spectra of the systems.

In conclusion, we do hope that the above papers will be able to capture the interest of a wide readership, provoke debates among engineers and scientists and give rise to further fruitful development of the current research.