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Scientific discipline: inżynieria mechaniczna / mechanical engineering

Abstract of the PhD thesis, titled: Method of efficient utilization of digital hydraulic concept in multisource hydrostatic drive systems

This doctoral dissertation analyzes the potential for effective use of the digital hydrostatic transmission concept in multi-source drive systems. The aim of the research is to determine whether it is possible to replace traditional hydrostatic transmissions, which typically utilize expensive and complex variable-displacement and/or fixed-displacement multi-piston pumps with throttling valves, with digital hydraulics- a concept based on simple sets and low-cost components, such as gear pumps and two-position on/off valves. The motivation for the research described in this dissertation is primarily the potential for such a solution to significantly reduce system construction costs, increase its reliability, and improve its environmental efficiency both in terms of component manufacturing and energy savings during operation (especially compared to throttling-controlled systems). Simulation and experimental studies of the digital hydrostatic transmission described in this paper have initially confirmed the feasibility of meeting the functional and energy requirements necessary for replacing a classic hydrostatic transmission with an equivalent built according to the digital hydraulics concept in multi-source hydrostatic systems. The advantages of replacing a classic hydrostatic transmission with its digital counterpart are most evident in the areas of capital and operating costs, increased system resilience to critical failures, and reduced environmental impact – particularly in terms of reducing the carbon footprint associated with component production and energy consumption during system operation. In light of these benefits, digital hydraulics represents an interesting alternative for the next generation of intelligent, energy-efficient hydrostatic drive systems, including multi-source systems.