Conception de moteurs à aimants permanents à flux axial ou radial à haute vitesse pour l'entraînement d'un compresseur contrarotatif

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Abstract
This thesis focuses on the design of high-speed, low-power permanent magnet motors specifically intended for driving a counter-rotating compressor. The primary objective is to ensure direct and compact integration of the motor, both in terms of length and volume, within the compressor wheels. To meet these requirements, several motor topologies—axial flux, radial 268 flux, and an innovative conical airgap structure—were modeled and evaluated. These evaluations included an in-depth analysis of electromagnetic and thermal performance, aimed at maximizing motor efficiency at high speeds. Particular attention was given to the study of electromagnetic losses, which become significant at these high speeds, for each of the considered topologies. In parallel, detailed mechanical analyses were conducted on disc-shaped rotors, which are sparsely documented in the literature, as well as on cylindrical rotors, to characterize their mechanical behavior at a rotational speed of 90,000 rpm. Manufacturing constraints ultimately led to the selection of the radial flux topology, which is currently under prototyping