

# Concept and Design of a Bearingless Spinfilter

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**Abstract**—In many separation processes, filtration performance degrades over time due to retained particles blocking the flow through the filter membrane. A novel bearingless spinfilter extends the long-term performance by self-cleaning effects. The filter rotor is magnetically levitated and actuated by two self-bearing motors inside a hermetically sealed housing, which eliminates the need for bearings and rotary sealings, that both lead to process fluid contamination. Both bearingless motors have integrated electronics and independently control the levitation of the spinfilter rotor. A first prototype is designed and the concept is validated by the separation of a yeast cell culture. Special focus is placed on the internal rotary seal between the feed and filtrate regions, that is inevitably created when the filter membrane is in motion. Any leakage flow through the seal leads to filtrate impurities, which is minimized in this paper with an embedded impeller as a pressure compensation method. A constant filtrate flux of  $1750 \text{ L h}^{-1} \text{ m}^{-2}$  and a filtrate purity of 75 % was achieved in a first series of tests.