



# Technical Paper

## Basic Research & Development

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## Performance curve stabilisation of axial flow pumps by passive flow control

#### Author:

**Dipl.-Ing. Petra Pérez Flores**  
Research Assistant  
Technische Universität Braunschweig, Pfeleiderer-Institut für Strömungsmaschinen  
38106 Braunschweig, Germany

#### Co-Author 1:

Prof. Dr.-Ing. Günter Kosyna  
Universitätsprofessor  
Technische Universität Braunschweig, Pfeleiderer-Institut für Strömungsmaschinen  
38106 Braunschweig, Germany

#### Co-Author 2:

Dr.-Ing. Detlev Wulff  
Akademischer Direktor  
Technische Universität Braunschweig, Pfeleiderer-Institut für Strömungsmaschinen  
38106 Braunschweig, Germany



## Summary

A large number of axial flow pumps exhibit an instability in their head performance curve. When reducing the flow rate to approximately 70 % of the design flow rate, a sudden drop of head occurs attended by severe vibrations as well as strong shaft and blade stresses. Hence the operating range is limited.

From a recent research project at the Pfleiderer-Institut it is known that grooves that are machined in the pump casing right upstream of the rotor, can stabilize the pump characteristic. This casing treatment also prevents vibrations and therefore allows an operation at flow rates lower than the stall point. The grooves are already used in industrial applications.

As axial flow pumps often have adjustable impeller blades, the paper will show the influence of the blade setting angle on the effectiveness of the grooves ability to stabilize the pump characteristic. For all tested blade angles the grooves are able to stabilize the performance curve. The vibrations however are not suppressed satisfyingly.

The paper will describe that the subsynchronous frequencies which occur at flow rates in the region of the head-drop will be suppressed by the grooves.

But there is one disadvantage namely strong cavitation at the grooves inlet area, which limits the operation on the former unstable branch of the characteristic to a short period of time. In the paper a double-inlet-nozzle is presented. It stabilizes the pump characteristic but avoids the mentioned cavitation problem at the grooves, offering steady operation for the entire pump characteristic.