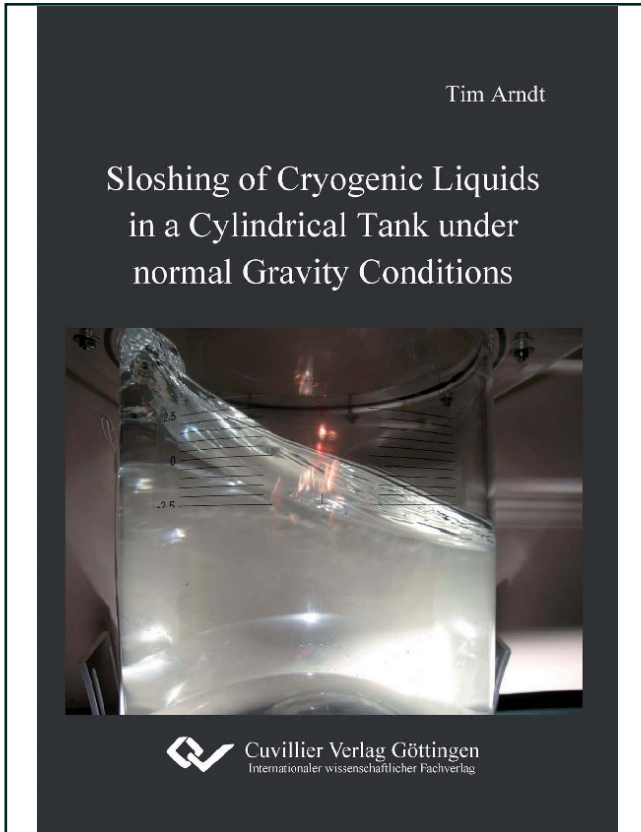




Tim Arndt (Autor)

Sloshing of Cryogenic Liquids in a Cylindrical Tank under normal Gravity Conditions



<https://cuvillier.de/de/shop/publications/4>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen,
Germany

Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: <https://cuvillier.de>



Contents

1	INTRODUCTION	1
1.1	State of the Art	6
1.2	Motivation and Objectives	7
2	THEORETICAL BACKGROUND	9
2.1	Governing Equations	10
2.1.1	Conservation of Mass	10
2.1.2	Conservation of Momentum	11
2.1.3	Conservation of Energy	12
2.2	Scaling Concept for Gravity Dominated Liquid Sloshing	14
2.3	The Pressure Drop Effect	25
2.4	Potential Theory	29
2.4.1	Solution of the Laplace Equation	31
2.4.2	Natural Frequencies	33
2.5	Damping	35
2.6	Spring Mass Model	38
2.6.1	Decay Function	39
2.6.2	Response Curve	40
3	EXPERIMENTAL SETUP	43
3.1	Sloshing Test Facility	43
3.2	Equation of Motion	46
3.3	Instrumentation	48
3.3.1	Force Measurement	48
3.3.2	Pressure Measurement	49
3.3.3	Temperature Measurement	50
3.4	Heat Input	51
3.5	Fluid Properties	53



4	RESULTS	55
4.1	Experimental Matrix	57
4.2	Damping Characteristics	58
4.3	The Pressure Drop Effect	63
4.3.1	Data Scaling	65
4.3.2	Self-pressurization	67
4.3.3	External Nitrogen Pressurization	81
4.3.4	Helium Pressurization	95
4.3.5	Upscaling of the Pressure Drop Data	115
5	CONCLUSIONS	125
5.1	Discussion of the Damping Results	125
5.2	Discussion of the Pressure Drop Results	127
6	OUTLOOK	131
7	SUMMARY	133
A	Tables	139
B	Figures	179