

Pressure Gain Combustion

Papers Presented at the AIAA Propulsion and Energy Forum
2021

Online
9-11 August 2021

ISBN: 978-1-7138-4345-0

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

The contents of this work are copyrighted and additional reproduction in whole or in part are expressly prohibited without the prior written permission of the Publisher or copyright holder. The resale of the entire proceeding as received from CURRAN is permitted.

For reprint permission, please contact AIAA's Business Manager, Technical Papers. Contact by phone at 703-264-7500; fax at 703-264-7551 or by mail at 34922 Uwytkug'Xcmg{'Ftkxg.'Uwky'422, Reston, VA 20191, USA.

TABLE OF CONTENTS

DIAGNOSTICS AND DEVICE MEASUREMENT

DATA-DRIVEN REGRESSION ANALYSIS OF PERFORMANCE PARAMETERS IN ROTATING DETONATION ENGINES	1
<i>Priya Patel, Vijay Anand, Alexander Zahn, Alexander Geller, Justas Jodele, Nathaniel Chiles, Tyler C. Pritschau, Ephraim Gutmark</i>	
ROTATING DETONATION OF HYPERGOLIC SPACE-STORABLE ROCKET PROPELLANTS WITH ADDITIVELY-MANUFACTURED INJECTOR DESIGN	22
<i>Anil P. Nair, David Morrow, Alex R. Keller, Alexander Lima, Daniel I. Pineda, R. Mitchell Spearrin</i>	
TIME RESOLVED FLOW FIELD IN THE RADIAL PLANE OF AN AEROSPIKE INTEGRATED WITH A ROTATING DETONATION COMBUSTOR.....	34
<i>Jonathan Tobias, Ajay K. Agrawal</i>	
HEAT TRANSFER MEASUREMENTS IN AN ELEVATED PRESSURE RDRE COMBUSTOR	47
<i>Daniel J. Micka, Gregory Daines, Jonathan Sosa, Robert F. Burke, Kareem A. Ahmed, Eric Paulson, John W. Bennowitz, Stephen Danczyk, William A. Hargus</i>	
ROTATING DETONATION ROCKET ENGINE SCALING USING VARIABLE ANNULAR WIDTH GEOMETRIES	60
<i>Blaine R. Bigler, Jason R. Burr, John W. Bennowitz, Stephen Danczyk, William A. Hargus</i>	

MODELING AND SIMULATION

LARGE-EDDY SIMULATIONS OF METHANE-OXYGEN COMBUSTION IN A ROTATING DETONATION ROCKET ENGINE	69
<i>Pinaki Pal, Sinan Demir, Prithwish Kundu, Sibendu Som</i>	
SYNTHETIC LASER DIAGNOSTICS OF SIMULATED RDRE EXHAUST.....	77
<i>Mathias Ross, Christopher Lietz, William A. Hargus</i>	
COMPARISON OF HYDROGEN COMBUSTION MECHANISMS FOR UNSTEADY SHOCK-INDUCED COMBUSTION WITH DYNAMIC MODE DECOMPOSITION (DMD) ANALYSIS	89
<i>Pradeep K. Pavalavanni, Min-Seon Jo, Jeongyeol Choi</i>	
SUPERSONIC COMBUSTION HEAT FLUX IN AN RDE MODEL	94
<i>Foluso Ladeinde, Hyejin Oh, Somnic Jacobs</i>	

INJECTORS AND INLETS

A METHOD FOR MODELING DYNAMIC INJECTOR RESPONSE IN A ROTATING DETONATION COMBUSTOR	111
<i>Piyush Raj, Joseph W. Meadows</i>	
PARAMETRIC EVALUATION OF RDE INLET PERFORMANCE USING A REDUCED-ORDER MODEL	135
<i>Clinton Bedick, Peter Strakey, Donald H. Ferguson</i>	

THERMODYNAMIC PERFORMANCE RESULTS FOR ROTATING DETONATION ROCKET ENGINE WITH DISTRIBUTED HEAT ADDITION USING CANTERA	146
<i>Jason R. Burr, Eric Paulson</i>	

PREDICTION OF DETONATION-INDUCED DISTURBANCES PROPAGATING UPSTREAM INTO INLETS OF ROTATING DETONATION COMBUSTORS.....	159
<i>Alexander Feleo, Joshua Shepard, Mirko Gamba</i>	

HOLLOW AND FLOW-THROUGH ROTATING DETONATION ENGINES

STUDY OF CYLINDRICAL ROTATING DETONATION ENGINE WITH PROPELLANT INJECTION COOLING SYSTEM	176
<i>Kosei Ota, Keisuke Goto, Noboru Itouyama, Hiroaki Watanabe, Akira Kawasaki, Ken Matsuoka, Jiro Kasahara, Akiko Matsu, Ikkoh Funaki</i>	

PERFORMANCE OF CENTERBODY-LESS ROTATING DETONATION COMBUSTORS FOR AN RDE CONCEPT	186
<i>Douglas A. Schwer, Ryan F. Johnson</i>	

ROTATING DETONATION MODE IDENTIFICATION VIA CROSS-CORRELATION AND SPOD THROUGH ETHYLENE/AIR IN HOLLOW COMBUSTORS	205
<i>Jorge J. Betancourt, Tyler C. Pritschau, Alec R. Gaetano, Rachel Wiggins, Vijay Anand, Ephraim Gutmark</i>	

TOMOGRAPHIC IMAGING OF ROTATING DETONATIONS IN A HOLLOW COMBUSTOR.....	217
<i>Alec R. Gaetano, Vijay Anand, Jorge J. Betancourt, Tyler C. Pritschau, Rachel Wiggins, Vincent G. Shaw, Ephraim Gutmark</i>	

ROTATING DETONATIONS THROUGH HYDROGEN-AIR MIXTURES IN A FLOW-THROUGH COMBUSTOR WITH VARYING CORE AIR FLOW	226
<i>Rachel Wiggins, Alec R. Gaetano, Tyler Pritschau, Jorge J. Betancourt, Vijay Anand, Ephraim Gutmark</i>	

PGC APPLICATIONS I

A REVIEW TOWARDS THE DESIGN OPTIMIZATION OF HIGH PERFORMANCE ADDITIVELY MANUFACTURED ROTATING DETONATION ROCKET ENGINE INJECTORS.....	232
<i>Thomas W. Teasley, Christopher S. Protz, Andrew P. Larkey, Benjamin B. Williams, Paul R. Gradl</i>	

USE OF A PARTIALLY PRE-MIXED INJECTION SCHEME AND PRE-DETONATOR IN A SMALL SCALE ROTATING DETONATION ENGINE.....	271
<i>Nathan T. Fiorino, Frederick R. Schauer, Marc D. Polanka, Stephen A. Schumaker, Brian C. Sell</i>	

EXPERIMENTAL STUDY ON TRUNCATED CONICAL ROTATING DETONATION ENGINE WITH DIVERGING FLOWS	287
<i>Kotaro Nakata, Kosei Ota, Shiro Ito, Kazuki Ishihara, Keisuke Goto, Noboru Itouyama, Hiroaki Watanabe, Akira Kawasaki, Ken Matsuoka, Jiro Kasahara, Akiko Matsu, Ikkoh Funaki</i>	

DESIGN AND TESTING OF A SMALL-SCALE LABORATORY ROTATING DETONATION ENGINE RUNNING ON ETHYLENE-OXYGEN	296
<i>Hamilton Law, Tom Baxter, Charlie N. Ryan, Ralf Deiterding</i>	

ELEVATED INLET TEMPERATURE EFFECTS ON THE OPERATION OF A ROTATING DETONATION COMBUSTOR	311
<i>Alexander Feleo, Joshua Shepard, Mirko Gamba</i>	

DETONATION PHYSICS I

DETONATION WAVE COLLISION STUDY DURING ROTATING DETONATION ROCKET ENGINE COUNTER-PROPAGATING MODES	321
<i>Armani Batista, Blaine R. Bigler, Mathias Ross, Christopher Lietz, William A. Hargus</i>	

A METHOD FOR DETERMINING HYDRODYNAMIC THICKNESS FROM A PRESSURE TRACE, APPLIED TO MIXTURES OF ETHYLENE AND NITROUS OXIDE	339
<i>Mitchell D. Hageman</i>	

INVESTIGATION OF COMPRESSIBLE TURBULENT HYDROCARBON FAST FLAMES TO DDT	353
<i>Rachel Hytovick, Hardeo M. Chin, Kareem A. Ahmed</i>	

EXPERIMENTAL INVESTIGATION OF THE UNSTEADY WALL HEAT FLUX DURING A SELF-SUSTAINED DETONATION PROPAGATION	358
<i>Hugo Quintens, Quentin Michalski, Florent Vivot, Bastien Boust, Julien Sotton, Marc Bellenoue</i>	

NON-ANNULAR ROTATING DETONATION ENGINES

WAVE DYNAMICS, POWER PRODUCTION AND COMBUSTION INSTABILITIES OF A DISK-SHAPED PRESSURE GAIN COMBUSTOR.....	367
<i>Xin Huang, Po-Hsiung Chang, Jiun-Ming Li, Chiang Juay Teo, Boo Cheong Khoo</i>	

3D NUMERICAL STUDY ON FLOW FIELD IN DISC-RDE	385
<i>A Koichi Hayashi, Kodai Shimomura, Nobuyuki Tsuboi, Kohei Ozawa, Nicolas H. Jourdain, Kazuhiro Ishii, Edyta Dzieminska, Tetsuro Obara, Shinichi Maeda, Toshiharu Mizukaki</i>	

ROTATING DETONATION ENGINE WITH A TAPERED COMBUSTION CHANNEL.....	393
<i>Nathan J. Snow, Marc D. Polanka, Frederick R. Schauer, Riley Huff, Matthew L. Fotia</i>	

OPERATING CHARACTERISTICS OF NON-CIRCULAR TRI-ARC ROTATING DETONATION ENGINE (RDE).....	405
<i>Eun Sung Lee, Hyung-Seok Han, Jung-Min Kim, Jae Hyuk Lee, Jeongyeol Choi</i>	

PGC APPLICATIONS II

COMPARISON STUDY OF INSTANTANEOUS OSCILLATORY BEHAVIOR BETWEEN RDRES AND AIR-BREATHING RDES	409
<i>Taha Rezzag, Robert F. Burke, Kareem A. Ahmed</i>	

A COMPUTATIONAL STUDY OF H ₂ -AIR ANNULAR ROTATING DETONATION COMBUSTOR OPERABILITY	415
<i>Venkat E. Tangirala, Anthony J. Dean</i>	

CHARACTERISTIC TIMESCALES FOR ROTATING DETONATION ROCKET ENGINES	431
<i>John W. Bennowitz, Jason R. Burr, Christopher F. Lietz</i>	

VALIDATION OF EXPERIMENTAL EVIDENCE FOR H ₂ /O ₂ POWERED ROTATING DETONATION ROCKET ENGINE	453
<i>Robert F. Burke, Taha Rezzag, Kareem A. Ahmed</i>	

DETONATION PHYSICS II

NUMERICAL INVESTIGATION OF COMBUSTION WAVE MODES IN HYDROGEN-AIR SHUTTLING TRANSVERSE COMBUSTION.....	460
<i>Ruiqin Shan, Heng Kee Ngiam, Jiun-Ming Li, Chiang Juay Teo, Boo Cheong Khoo</i>	

NUMERICAL STUDY ON NO _x EMISSIONS FROM A SYNTHETIC BIOFUEL FOR APPLICATIONS IN DETONATION-BASED COMBUSTORS.	470
<i>Ashlesh P. Dahake, Ajay V. Singh</i>	

NO _x EMISSIONS FROM JET A-AIR DETONATIONS.....	483
<i>Karthikeyan M. Iyer, Ajay V. Singh</i>	

DYNAMIC MODE DECOMPOSITION (DMD) ANALYSIS OF THE DETONATION CELL- BIFURCATION PROCESS	495
<i>Pradeep K. Pavalavanni, Jaehoon Ryu, Jeongyeol Choi</i>	

PGC APPLICATIONS III

EFFECTS OF INLET AREA RATIO ON OPERABILITY OF AN AXIAL AIR INLET ROTATING DETONATION COMBUSTOR	500
<i>Joshua Shepard, Alexander Feleo, Mirko Gamba</i>	

EXPERIMENTAL STUDY OF A RACETRACK-TYPE ROTATING DETONATION ROCKET ENGINE WITH SHEAR-COAXIAL INJECTORS RUN ON GASEOUS METHANE AND OXYGEN	520
<i>Evan C. Unruh, James P. Venters, Michaela Hemming, David M. Lineberry, Kunning G. Xu, Robert A. Frederick</i>	

COMPARISON OF VALVED-PULSEJET COMBUSTION OPERATION USING ETHANOL AND GASOLINE FUELS	547
<i>Mohamad M. Ghulam, Shyam S. Muralidharan, Vijay Anand, Erik Prisell, Owe Lyrsell, Ephraim Gutmark</i>	

Author Index