

TABLE I
DATABASE OF THE REFERENCED WORKS ON DAMPING IN ACTUATION UNITS

DATABASE								
Year	Paper Title	First Author	Damping Mode	Class of Technology	Technology	Topology	Group of Application	Application
1991	Design of components for programmable passive impedance	K.K. Laurin-Kovitz	S.A.	FDB	F.D.	SEDA	H.R.I	G.P.
1995	An Electro-Rheological Fluid Damper for Robots	J. Li	S.A.	VRB	E.R.	-	G.P.	G.P.
2000	Development and Analysis of an Actuator with E.R. Damper	N. Takesue	S.A.	VRB	E.R.	SEAwPD	ICR	I.D.
2000	Force Controllable Hydro-Elastic Actuator	D.W. Robinson						
2004	Variable Transmission Compliance with a M.R. Damper	E. Westervelt	S.A.	VRB	M.R.	SEDA	G.P.	G.P.
2004	Series Damper Actuator: A novel force/torque control actuator	C.M. Chew	S.A.	VRB	M.R.	SEDA	G.P.	G.P.
2004	Two Semi-Active Approaches for Vibration Isolation: PiezoElectric Friction Damper and Magneto-rheological Damper	M. Unsal	S.A.	FBD/VRB	F/M.R.	-	G.P.	G.P.
2005	Damp-By-Wire: Magneto-rheological vs Friction Dampers	E. Guglielmino	S.A.	FBD/VRB	M.R./F.	-	G.P.	G.P.
2006	Improved Concept of a Eddy Current Damper	H.A. Sodano	S.A.	EMB	E.C.	-	G.P.	G.P.
2006	Artificial Human Limbs and Joints Employing Actuators, Springs, and Variable-Damper Elements	H. Herr	S.A.	VRB	M.R.	SEDA	MHW	PR
2006	On the use of eddy current brakes as tunable, fast turn-on viscous dampers for haptic rendering	A.H.C. Gosline	S.A.	EMB	E.C.	-	MHW	HD
2007	Artificial Ankle-Foot System with Spring Variable Damping and Series Elastic Actuator Components	H. Herr	S.A.	-	-	SEDA	HAL	LR
2007	A 3-D Rehabilitation system for upperlimbs EMUL and a 6dof rehabilitation system "robotherapist" and other rehabilitation System with high safety	J. Furusho	S.A.	VRB	E.R.	SEDA	MHW	RR
2008	Eddy Current Brakes for Haptic Interfaces: Design, Identification, and Control	A.H.C. Gosline	S.A.	EMB	E.C.	-	MHW	HD
2008	Modeling of Magneto Rheological Fluid Actuator Enabling Safe Human-Robot Interaction	R.M. Ahmed	S.A.	VRB	E.R.	SEDA	ICR	CR
2008	Evaluation of Electrorheological Fluid Dampers for Applications at 3-T MRI Environment	A. Khanicheh	S.A.	VRB	E.R.	SEAwPD	MHW	MR
2009	A novel Eddy Current Damper: Theory and Experiment	B. Ebrahimi	PA.	EMB	E.C.	-	G.P.	G.P.
2009	Compact MR fluid clutch device for human-friendly actuator	T. Kikuchi	S.A.	VRB	M.R.	-	HAL	A.R.
2009	Passive Electromagnetically Damped Joint	J.J.Martin	S.A.	EMB	E.M.	-	MHW	PR
2010	A variable physical damping actuator (VPDA) for compliant robotic joints	M. Laffranchi	S.A.	FBD	F.	SEDA	ICR	C.R.
2010	Design of a variable impedance differential actuator for wearable robotic applications	N.L. Tagliamonte	S.A.	FBD	F.	SEDA	MHW	WR
2010	Characterization of a Series Viscous Actuator For Use in Rehabilitative Robotic	N.E. Wiltsie	S.A.	FBD	V.E.	SEDA	MHW	RR
2010	Dual-Differential Rheological Actuator for High-Performance Physical Robotic Interaction	P.Fauteux	S.A.	VRB	M.R.	SEAwPD	HAL	AR
2011	Combining Series Elastic Actuation and Magneto-rheological Damping for the Control of Agile Locomotion	E. Garcia	S.A.	VRB	M.R.	SEDA	HAL	LR
2011	Series Clutch Actuators for Safe Physical Human-Robot Interaction	M. Lauzier	S.A.	FBD	F.	SEDA	ICR	CR
2011	A Compact Compliant Actuator (CompAct) with Variable Physical Damping	M. Laffranchi	S.A.	FBD	F.	SEAwPD	ICR	CR
2011	Design of a rotary passive viscoelastic joint for wearable robots	G. Carpino	PA.	FDB	F.D.	SEDA	MHW	WR
2012	The role of physical damping in compliant actuation systems	M. Laffranchi	S.A.	FBD	F.	-	G.P.	G.P.
2012	A Variable Damping Module for Variable Impedance Actuation	M.G. Catalano	S.A.	FDB	F.D.	SEAwPD	HAL	HP
2012	BLUE: A Bipedal Robot with Variable Stiffness And Damping	A. Enoch	PA.	EMB	E.M.	SEDA	HAL	HP

2012	Analysis and development of a semiactive damper for compliant actuation systems	M. Laffranchi	S.A.	FBD	F.	SEAwPD	ICR	CR
2012	pVEJ: a modular passive viscoelastic joint for assistive wearable robots	D. Accoto	PA.	FDB	F.D.	-	MHW	WR
2013	Design and experimental evaluation of a multidisk magnetorheological fluid actuator	D. Wang	S.A.	VRB	M.R.	SEAwPD	G.P.	G.P.
2013	Compact Arm: a compliant manipulator with intrinsic variable physical damping	M. Laffranchi	S.A.	FBD	F.	SEAwPD	ICR	CR
2014	Development and control of a series elastic actuator equipped with a semi active friction damper for human friendly robots	M. Laffranchi	S.A.	FBD	F.	SEAwPD	HAL	HP
2014	Development of a hybrid actuator with controllable mechanical damping	I. Sarakoglou	S.A.	FBD	F.	SEAwPD	MHW	HD
2015	Damping Control of Variable Damping Compliant Actuators	N. Kashiri	S.A.	FBD	F.	SEAwPD	G.P.	G.P.
2016	Dynamics and Control of an Anthropomorphic Compliant Arm Equipped With Friction Clutches	N. Kashiri	S.A.	FBD	F.	SEAwPD	G.P.	G.P.
2016	Performance Evaluation of a Compliant Magnetorheological Piston Actuator	G. Dominguez	S.A.	VRB	M.R.	SEAwPD	ICR	IR
2016	Viscoelastic Liquid Cooled Actuators	L. Sentis	PA.	FBD	F.	SEAwPD	G.P.	G.P.
2017	A Self-Adaptive Variable Impedance Actuator Based on Intrinsic Non-linear Compliance and Damping Principles	N. Kashiri	PA.	FBD	F.	SEAwPD	G.P.	G.P.
2017	Research on Variable Stiffness and Damping Magnetorheological Actuator for Robot Joint	X. Dong	S.A.	VRB	M.R.	SEAwPD	HAL	HP
2017	Generation of Locomotion Trajectories for Series Elastic and viscoelastic bipedal robots	A. Werner	PA.	FDB	F.D.	SEAwPD	HAL	LR
2018	Continuously Controllable Series Clutches for Efficient Robot Actuation	J. Malzahn	S.A.	FBD	F.	SEAwPD	G.P.	G.P.
2018	Design and Control of a Variable Viscous Damping Actuator (VVDA) for compliant robotic joints	D. Zhi	S.A.	FDB	F.D.	SEAwPD	HAL	HP
2018	Investigations of a Robotic Testbed with viscoelastic liquid cooled actuators	D. Kim	PA.	FBD	V.E.	rSEAwPD	HAL	LR
2018	Optimal design and torque control of an active magnetorheological prosthetic knee	R.M. Andrade	S.A.	VRB	M.R.	SEAwPD	MHW	RR
2018	Active and Semi-Active Damping in a telesurgical system	R.L. Devengenzo	S.A.	-	-	-	MHW	MD
2019	Control High Performance Bipedal Robot using Viscoelastic liquid cooled actuators	J. Ahn	PA.	FBD	V.E.	SEAwPD	HAL	HP
2020	Effective Viscous Damping Enables Morphological Computation in Legged Locomotion	A. Mo	S.A.	FBD	F.	-	MHW	WR
2020	Compact Series Visco-Elastic Joint (SVEJ) for Smooth Torque Control	D. Chiaradia	PA.	FBD	V.E.	SEAwPD	MHW	WR
2020	Energy Regenerative Damping in Variable Impedance Actuators for Long-Term Robotic Deployment	F. Wu	S.A.	EMB	E.M.	SEAwPD	HAL	LR
2020	A Supernumerary Robotic Leg Powered by Magnetorheological Actuators to Assist Human Locomotion	C. Khazoom	S.A.	VRB	M.R.	SEAwPD	MHW	WR

TABLE II

CONTINUATION OF TABLE I.

ACRONYM

DAMPING TYPE: PASSIVE = PA., SEMI-ACTIVE = S.A.; **CLASS OF TECHNOLOGY:** FLUID DYNAMICS BASED DAMPERS = FDB, VARIABLE RHEOLOGY FLUID BASED DAMPERS = VRB, ELECTROMAGNETISM BASED DAMPERS = EMB, FRICTION BASED DAMPERS = FBD; **TECHNOLOGY:** FLUID = FD, ELECTRO-RHEOLOGICAL FLUID = ER, MAGNETO-RHEOLOGICAL FLUID = MR, FRICTION = F., EDDY CURRENTS = EC, ELECTRO-MAGNETIC = EM, VISCO-ELASTIC MATERIAL = VE; **APPLICATIONS:** ASSISTIVE ROBOTS = AR, COLLABORATIVE ROBOTS = CR, HAPTIC DEVICES = HD, HUMANOID PLATFORMS = HP, INDUSTRIAL ROBOTS = IR, LOCOMOTION = LR, MEDICAL ROBOTS = MR, PROSTHESES = PR, REHABILITATIVE ROBOTS = RR, WEARABLE ROBOTS = WR, GENERAL PURPOSE = GP.