DUAL-ARM CLOTH MANIPULAION BENCHMARK- FOLDING

Reference No / Version	B-DACM-F-0.1
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Adopted Protocol	P-DACM-F-0.1
Scoring	Fill the attached table or use the provided xls or ods sheet according to the following rules. Specify the size of the towel, if **[st]** or **[bt]**. Indicate in the graphic which are the planned grasping points for the first and second grasp, and for the second and third fold. Depending on the starting configuration, either **[pg2]**, **[pg1]**, **[cr]** or **[ft],** fill out the respective table. For each trial, report the following scores: 1. Success **[MAN]**: report 1 if the **[MAN]** phase is successfully executed, 0 otherwise; Success is considered when opposite corners lay together. If one corner is folded and robot can't correct it, then it is a failure. If there are wrinkles, it is a success but the quality function will reflect it. 2. Success **[GR2]**: in cases **[pg1]**, **[cr]** and **[fr]**, report 1 if the second grasp is successfully executed and maintained through all the **[MAN]** phase. If the grasped point does not allow the **[MAN]** phase to be executed or the object is lost during manipulation due to a poor grasp, report a 0. Do not report any value in case **[pg2]**; 3. Success **[GR1]**: in cases **[cr]**, and **[ft]**, report 1 if the grasp is successfully executed, maintained during all the other phases and the grasped point allows to execute the manipulation, 0 otherwise. Do not report any value in cases **[pg2]** and **[pg1]**; 4. Execution time: measure the time in seconds for the system to complete the task. Time starts when the autonomous method is started and ends when the task is completed; 5. Forces: if the used system is equipped with

	force/torque sensors report the minimum, maximum and average norms of the forces measured at the end effectors during the **[MAN]** phase. Note that data from both manipulators must be considered. In case no sensors are available, ignore these measures; 6. Quality function: once the task is finished, measure the area of the towel from a top view to evaluate the quality function (it is automatically computed with xls and ods files). Specify which assumptions are considered among the following ones: • The table color is known; • The table position is known; • The illumination condition can not vary; • The towel color is known; • The dimensions of the towel are known; • Assumptions on folded configuration 1: Grasping point is on the top layer of the cloth; • Assumption on folded configuration 2: Folded to make the robot grasp short edge of towel. Robot can not distinguish if it grasped the long or the short edge of the towel; • Assumption on crumpled configuration 1: Grasping point is visible and on the table; • Assumption on crumpled configuration 2: Cloth is placed so that robot will grasp the short edge. Robot can not distinguish if it grasped the long or the short edge of the towel. Report any additional assumption considered to solve the task. Note that the above information must be reported for the different foldings individually. Finally, after all the info is filled in, automatically the summary table will contain the following information: • Success rate for each phase; • Average of the quality functions for the successful cases. • Average and variance of the execution time; • Average and variance of the minimum force norm over successful trials (if available); • Average and variance of the maximum force norm over successful trials (if available);

	• Average and variance of the mean force norm over successful trials (if available); • Number of assumptions needed from the given list; • Use of further assumptions (yes/no depending on if new assumptions are considered or not).
Details of Setup	Provide a detailed description of: • Robots; • End effectors; • Utilized sensors; • Dimensions of the table; • Software architecture.
Results to Submit	Videos of each trial; Filled out scoresheet; Top view pictures of final results at each fold. Detailed comments on: • What makes the system successful? • What makes the system fail? • What was improved compared to other methods? • Chosen grasping points and/or grasping strategy.

Object	[bt] | [st]																										
	First fold							Second fold							Third fold												
Start. config.	Succ. [GR1] (1 | 0)	Succ. [GR2] (1 | 0)	Succ. [MAN] (1 | 0)	Ar. bef.	Ar. aft.	QF	Time in sec	Succ. [GR1] (1 | 0)	Succ. [GR2] (1 | 0)	Succ. [MAN] (1 | 0)	Ar. bef.	Ar. aft.	QF	Time in sec	Succ. [GR1] (1 | 0)	Succ. [GR2] (1 | 0)	Succ. [MAN] (1 | 0)	Ar. bef.	Ar. aft.	QF	Time in sec	Assump.	Used (YES | NO)	Assump.	Used (YES | NO)	New Assump.
[pg2]| [pg1]| [ft]| [cr]						-							-									-		Towel color		Grasp points visible		
						-							-									-		Table position		Illumination changes		
						-							-									-		Object position				
						-							-									-		Cloth color				
						-							-									-		Towel size				
Summ:	0.00%	0.00%	0.00%			-	-	0.00%	0.00%	0.00%			-	-	0.00%	0.00%	0.00%			-	-	**Assump.**	0/7	**New Assump.**		**NO**