BIMANUAL CLOTH MANIPULATION BENCHMARK-SPREADING

Reference No / Version	RAL-SI-2020-B19-0832_1-V1.0 (for the latest versions of the benchmark, please refer to https://ral-si.github.io/cloth-benchmark/#resources or http://www.ycbbenchmarks.org/protocols-and-benchmarks/)
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Adopted Protocol	RAL-SI-2020-P19-0832_1-V1.0
Scoring	Fill the attached table or use the provided xls or ods sheet according to the following rules. Indicate in the graphic which are the planned grasping points for the first and second grasp. Depending on the starting configuration, either **[pg2]**, **[pg1]**, **[cr]** or **[fd],** 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; We assume it is successfully executed when the tablecloth is covering the top of the table; 2. Success **[GR2]**: in cases **[pg1]**, **[cr]** and **[fd]**, 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, report a 0. Do not report any value in case **[pg2]**; 3. Success **[GR1]**: in cases **[cr]**, and **[fd]**, 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 first robot starts to move and ends when the task is

completed;

5. Forces: if the force measures are available, report the minimum, maximum and average norms of the forces at the end effectors measured during the **[MAN]** phase. Note that data from each robot must be considered;
6. Quality function: once the task is finished, measure the dropping lengths of the tablecloth indicated in Figure *1* and evaluate the quality measures (they are automatically computed in xls and ods files). Annotate and take pictures of any abnormal configuration that should be reported but does not reflect on the quality function, e.g. a wrinkle on the top or the hanging parts.

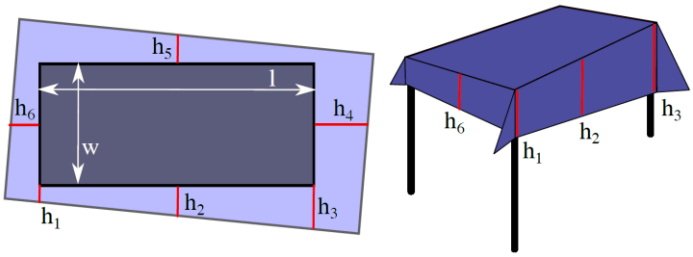

Figure 1 - Measures for quality function

Execution time and quality functions will be averaged only over successful executions. That is, it must always be considered in accordance to the success rate.
Specify which assumptions are considered among the following ones:

- The table color is known;
- The table position is known;
- The color of the tablecloth is known;
- The position of the tablecloth is known;
- The dimensions of the tablecloth are known;
- The illumination condition can not vary.

Report any additional assumption considered to solve the task and specify how it affects the solution.

Finally, fill the summary table containing the following information (it is automatically filled if the xls or ods scoresheets are used):

- 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 and respective number of motors; • End effectors; • Utilized sensors; • Dimensions of the table; • Software architecture.
Results to Submit	Videos of each trial; Filled out scoresheet; Pictures of any abnormal end configuration of the cloth that does not reflect in the quality function, e.g. undesired wrinkles. 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.

Start. config.	Succ. [MAN] (1 | 0)	Succ. [GR2] (1 | 0)	Succ. [GR1] (1 | 0)	h1	h2	h3	h4	h5	h6	QF rotat.	QF length	QF width	Time in sec	Force measures (norm in N)			Assump.	Used (YES | NO)	Assump.	Used (YES | NO)	New assump.
														min	*avg*	*max*					
[pg2] | [pg1] | [cr] | [fd]										0	0	0					Table color		Illumination changes		
										0	0	0					Table position				
										0	0	0					Tablecloth color				
										0	0	0					Tablecloth position				
										0	0	0					Tablecloth dimensions				
Sum.:	**0.00%**	**0.00%**	**0.00%**							**-**	**-**	**-**	**avg: -**	**avg: -**	**avg: -**	**avg: -**	**Assump.:**	**0/6**	**New assump.:**		**NO**
													var: -	**var: -**	**var: -**	**var: -**					

Table dimensions (cm)			**Tablecloth dimensions** (cm)			**Planned grasping points**
Length	120		**Length**	240		
Width	70		**Width**	145		