

Would you like to continue?

	Percent	Respondents
Yes	99.0%	510
No	1.0%	5
Total	100.0%	515

For how long have you used simulation tool(s) to simulate a robot and/or used URDF files?

	Percent	Respondents
Less than 1 year.	10.0%	51
Between 1 and 5 years.	61.2%	312
Between 6 and 10 years.	16.7%	85
More than 10 years.	9.6%	49
Never.	2.5%	13
Total	100.0%	510

In which of these types of environments have you used simulation tool(s) to simulate a robot and/or used URDF files?

	Percent	Respondents
Academia	82.3%	409
Industry	52.5%	261
Government	4.0%	20
Unaffiliated groups (e.g., Open Source Robotics Foundation, a drone hobbyist group, a school club)	14.7%	73
Individual	25.8%	128
Other	0.4%	2
Total	100.0%	497

If you have used simulation tool(s) to simulate a robot and/or used URDF files at any organization, how large was the most recent organization?

	Percent	Respondents
1-10	26.0%	128
11-50	23.7%	117
51-100	10.3%	51
100+	40.0%	197
I haven't used simulation tool(s) to simulate a robot and/or used URDF files at an organization	0.0%	0
Total	100.0%	493

If you have simulated a robot before, when was the last time you did this?

	Percent	Respondents
In the last month.	70.6%	351
In the last year.	23.7%	118
In the last 5 years.	4.4%	22
More than 5 years ago.	0.6%	3
I have not simulated a robot before.	0.6%	3
Total	100.0%	497

Why not?

	Percent	Respondents
Not applicable	66.7%	2
Too difficult	0.0%	0
Other	33.3%	1
Total	100.0%	3

If you have simulated a robot with 3D visualizations, which tools have you used to do this?

	Percent	Respondents
CoppeliaSim (formerly V-REP)	25.5%	126
FlexSim	0.6%	3
Gazebo	82.8%	409
MATLAB/MathWorks	30.4%	150
Peter Corke's Robotics Toolbox (for MATLAB or Python)	23.7%	117
RoboDK	7.7%	38
RViz	78.3%	387
Unity	18.8%	93
Unreal Engine	9.7%	48
Visual Components	3.6%	18
Webots	13.2%	65
Custom simulator	12.6%	62
Other	20.9%	103
I have not simulated a robot with 3D visualizations.	0.2%	1
Total	100.0%	494

Why not?

	Percent	Respondents
Not applicable	100.0%	1
Too difficult	0.0%	0

Other	0.0%	0
Total	100.0%	1

Have you heard of (Unified Robot Description Format) URDF before?

	Percent	Respondents
Yes	96.0%	477
No	4.0%	20
Total	100.0%	497

If you have used URDFs before, for how long have you been using them?

	Percent	Respondents
Less than 1 year.	16.1%	77
Between 1 and 5 years.	61.8%	295
Between 6 and 10 years.	15.7%	75
More than 10 years.	5.2%	25
I have not used URDFs before.	1.0%	5
Total	100.0%	477

Why not?

	Percent	Respondents
Not applicable	20.0%	1
Too difficult	20.0%	1
Other	60.0%	3
Total	100.0%	5

When was the last time you used a URDF?

	Percent	Respondents
In the last month.	66.5%	314
In the last year.	27.3%	129
In the last 5 years.	5.3%	25
More than 5 years ago.	0.8%	4
Total	100.0%	472

How experienced do you feel you are with URDFs?

	Percent	Respondents
Beginner	21.8%	103
Intermediate	57.4%	271
Expert	20.8%	98

Total	100.0%	472
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In which application domains have you used URDFs?

	Percent	Respondents
Agriculture	14.4%	68
Cleaning	7.8%	37
Defense	6.4%	30
Manufacturing	45.8%	216
Marine	5.9%	28
Medical	12.3%	58
Transportation	23.9%	113
Other	33.5%	158
Total	100.0%	472

Which manufacturers of robots or end effectors have you used URDFs of?

	Percent	Respondents
ABB	21.2%	100
Boston Dynamics	9.1%	43
Clearpath Robotics	21.0%	99
Fanuc	10.4%	49
Franka Emika	26.3%	124
Kinova Robotics	14.8%	70
Kuka	37.1%	175
Robotiq	23.5%	111
Universal Robots	54.0%	255
Willow Garage	14.0%	66
Yaskawa Motoman Robotics	5.7%	27
Other	39.8%	188
Total	100.0%	472

Which types of robots have you used URDFs of?

	Percent	Respondents
Robotic arm (single arm)	81.1%	383
Dual arm robot	22.5%	106
Delta robot	4.0%	19
Humanoid robot	16.5%	78
Mobile robot	63.8%	301

Quadrupedal robot	14.6%	69
End effectors	39.4%	186
Drone	14.6%	69
Other	5.7%	27
Total	100.0%	472

10. How have you used URDFs?

	Percent	Respondents
Always in combination with ROS.	65.9%	311
Always in combination with ROS, but would prefer not to require ROS.	17.8%	84
Without ROS.	16.3%	77
Total	100.0%	472

Are you aware of any of the following or other tools for creating URDFs?

	Percent	Respondents
Fusion2URDF	17.5%	77
OnShape to URDF exporter	12.2%	54
Phobos (Blender extension)	11.6%	51
PTC Creo to URDF exporter	3.6%	16
Solidworks URDF exporter	57.1%	252
xacro	81.9%	361
Other	4.3%	19
Total	100.0%	441

Have you ever used the tool 'xacro' to generate URDFs?

	Percent	Respondents
Yes	90.0%	325
No	10.0%	36
Total	100.0%	361

Have you ever used URDF models (xml file + meshes) with geometrical meshes of the robot (i.e., not just boxes or cylinders, etc.)?

	Percent	Respondents
Yes	93.0%	439
No	7.0%	33
Total	100.0%	472

How did you obtain the URDF models? Please mention the specific tools.

	Percent	Respondents
From simulation tool	19.8%	87
From CAD tool	60.6%	266
From ROS package	59.5%	261
From website of the robot manufacturer	47.4%	208
Developed the URDF by hand	67.2%	295
Other	2.3%	10
Total	100.0%	439

If you have earlier created/modified a URDF model, what level of difficulty would you rate the process?

	Percent	Respondents
Easy	6.8%	30
Medium	57.2%	251
Difficult	32.1%	141
Don't know	1.1%	5
I have not created/modified URDF models before.	2.7%	12
Total	100.0%	439

Have you faced any challenges or limitations with URDFs?

	Percent	Respondents
Incorrect forward kinematics.	25.9%	114
Difficulty importing the URDF into simulation tool.	43.9%	193
Difficulty creating a URDF file.	48.4%	213
Difficulty adding end effector model to robotic arm model.	32.7%	144
Could not find a URDF with the specific version of the robot I want to simulate.	38.2%	168
Limitation in URDF did not allow creating model of robot with parallel linkages.	40.2%	177
Other	10.0%	44
Total	100.0%	440

Are there any improvements you would like for URDF?

	Percent	Respondents
A versioned standard (i.e., URDF v1.0, URDF v1.1, etc.)	35.1%	162
Better tools for combining and manipulating URDF files	70.3%	324
Better tools for validating URDF files	64.6%	298
Better documentation	55.7%	257
Easier methods or tools to create URDF files	68.5%	316

Standardized metadata like originator, date, version, etc.	27.5%	127
Other	11.3%	52
Total	100.0%	461

Do you think that URDF will be more commonly used in the future? Please justify if possible.

	Percent	Respondents
Yes	53.5%	255
No	12.2%	58
Don't know	34.4%	164
Total	100.0%	477

Overall Status

	Percent	Respondents
New	0.0%	0
Distributed	0.0%	0
Partially Complete	0.0%	0
Complete	100.0%	515
Rejected	0.0%	0
Total	100.0%	515

Collection Status

	Percent	Respondents
None	0.0%	0
Partially Complete	0.0%	0
Completed	100.0%	515
Rejected	0.0%	0
Total	100.0%	515