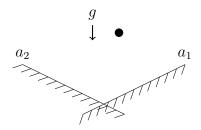
Homework 12: Time-stepping

24-760 Robot Dynamics & Analysis Fall 2022

Name:

Problem 1) Falling Ball



Consider a point particle that can make plastic frictionless impact with several constraints. Assume the particle is mass 1 and gravity is 9.8. Let the constraints be $a_1(x, y) = 2y - x$ and $a_2(x, y) = 2y + x$.

- 1.1) Simulate the system with an event-based simulation in Matlab using ode45 and an event function. You are encouraged to reuse any code that you would like from past homeworks.
- 1.2) Run a simulation from initial condition (0.2, 1) for 3 seconds. What contact mode transitions occur and at what times? Discuss any problems that arise.
- 1.3) Now simulate the same system with a time-stepping simulation in Matlab using solve. At each timestep, pass the full system of equations (including the difference equations for \dot{q} and q as well as all inequality and complementarity constraints) to solve in order to find the next q, \dot{q} , and λ . The following Matlab resources may help:

https://www.mathworks.com/help/symbolic/solve.html https://www.mathworks.com/help/symbolic/solve-a-system-of-algebraic-equations.html

1.4) Run a simulation from initial condition (0.2, 1) for 3 seconds with time-step sizes h of 40, 20, and 10 ms. What contact mode transitions occur and at what times? In time-stepping the "contact mode" can be interpreted as those constraints who provided a positive force or impulse over the time step (as we cannot differentiate between these), though the system may not meet all of the requirements for the domain D_I in the hybrid system sense. Discuss any differences between these and the event-based simulation.

ransitio	ns occu	r an	d at v	what	time	s? I	Discu	ıss an	у р	rob	lem	s th	at	arise	Э.																
Init	ial co	ndit	ion:	[0.	2			1]'								72						,		0	h.			,			
	sition															110	4	W	45	A .	Prot	un	^	(0	THE	·	id o	+ 1	ne.		
	sition sition															Si	m	wh	we.	1n	- 1	all	540	yped	- +	رحم	i fio	~~	ne to		
Tran	sition	to	cont	act	mode	{2	} at	time	e t	= 3	1.5	608	S.			pl.	įw	CONT	act	0,	1	phas	es	thr	ngh		123	to			
	sition sition															fa	·u	off	50	ru.	٦.										
Tran	sition	to	cont	act	mode	{1	} at	time	e t	= 2	2.0	134	s.	_																	
	sition sition																														
Tran	sition	to	cont	act	mode	{2	} at	time	e t	= 2	2.1	112	s.																		
	sition sition																														
Tran	sition	to	cont	act	mode	{1	} at	time	e t	= 2	2.1	323	s.																		
	sition sition																														
Tran	sition	to	cont	act	mode	{2	} at	time	e t	= 2	2.1	368	S.																		
	sition sition																														
Tran	sition	to	cont	act	mode	{1	} at	time	e t	= 2	2.1	378	s.																		
	sition sition																														
	l time																														
									+	+																					
									+	+																					
									+									-												-	
									+	+																_					
									+																						

| resping the "contact mode" can be interpreted as those constraints who provided a positive wore of impalse over the time step (as we cannot differentials between these), though the system are more than the step of the step |), and | l 10 | ms. | What | con | tact r | node | tran | 0.2, 1) sitions | s occ | eur a | nd a | at w | hat | $_{ m time}$ | s? I | n tin | ne- | | | | | | | | | | | |
|--|---------|-----------------|--|--|--
--	---	--	--
--	--	---	--
--	---	---	--
---	--	--	---
Secus any not meet all of the requirements for the domain D ₂ in the hybrid system sense. Secus any differences between these and the event-based simulation. Note	_		
 | - | | | |
 | | | - | |
 | | | | | | |
 | | | | |
 | |
Initialize in mode {0}. Transition from mode {2} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} 2} at t = 0.4. Transition from mode {2} to mode {1} 2} at t = 0.4. Transition from mode {2} to mode {1} 2} at t = 0.4. Transition from mode {2} to mode {1} 2} at t = 1.16. Transition from mode {2} to mode {2} at t = 1.16. Terminate in mode {1} 2} at t = 3. 20mi					
 | | | | |
 | | | | |
 | _ | | | | | |
 | | | | |
 | |
| Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} 2 at t = 0.48. Transition from mode {1} to mode {1} 2 at t = 0.52. Transition from mode {1} to mode {2} at t = 1.6. Transition from mode {2} to mode {1} 2 at t = 1.16. Transition from mode {2} to mode {2} at t = 1.16. Transition from mode {0}. Transition from mode {0}. Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.1. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.14. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {2} at t = 3. Initialize in mode {0}. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {2} to mode {1} at t = 1.55. Transition from mode {2} to mode {2} at t = 1.63. Transition from m | | | | | |
 | | | | |
 | | | пуы | na sy | sten
 | n sen | se. | | | | |
 | | | | |
 | |
Initialize in mode {0}. Transition from mode {2} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} 2) at t = 0.48. Transition from mode {1} to mode {1} 2) at t = 0.52. Transition from mode {1} to mode {2} at t = 1. Transition from mode {1} to mode {2} at t = 1. Transition from mode {2} to mode {1} 2 at t = 1.66. Terminate in mode {1} 2) at t = 3.					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Initialize in mode {0}. Transition from mode {2} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} 2) at t = 0.48. Transition from mode {1} to mode {1} 2) at t = 0.52. Transition from mode {1} to mode {2} at t = 1. Transition from mode {1} to mode {2} at t = 1. Transition from mode {2} to mode {1} 2 at t = 1.66. Terminate in mode {1} 2) at t = 3.	-				
 | | - | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.48. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.16. Transition from mode {1} to mode {2} at t = 1.16. Transition from mode {2} to mode {1} at t = 1.16. Terminate in mode {1} at t = 3. h > 20mi: Initialize in mode {0}. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.54. Terminate in mode {1} at t = 3. Initialize in mode {1} at t = 3. Initialize in mode {1} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {2} to mode {1} at t = 1.62. Transition from mode {2} to mode {1} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {3} to mode {3} at t = 1.63. Transition from mode {4} to mode {4} at t = 1.70. Transition from mode {4} to mode {4} at t = 1.70. Transition from mode {4} to mode {4} to mode {4} to t = 1.70. Transition from mode {4} to mode {4} to mode {4} to at t = 1.63. Transition from mode {4} to mode {4} to mode {4} to t = 1.63. Transition from mode {4} to mode {4} t	= 40	ms	ď		
 | _ | _ | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} 2 at t = 0.48. Transition from mode {1} 2 to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.6. Transition from mode {1} to mode {2} at t = 1.16. Transition from mode {2} to mode {1} 2 at t = 1.16. Transition from mode {2} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} 2 at t = 1.12. Transition from mode {2} to mode {1} 2 at t = 1.12. Transition from mode {2} to mode {1} 2 at t = 1.42. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {1} to mode {1} 2 at t = 1.54. Transition from mode {2} to mode {1} 2 at t = 1.54. Transition from mode {2} to mode {1} 2 at t = 1.54. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {2} to mode {2} at t = 0.42. Transition from mode {2} to mode {2} at t = 1.62. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.71. Transition from mode {3} to mode {4} to mo						
 | | | |
 | | | | | |
 | | | | | |
 | | | | |
 | |
Transition from mode {2} to mode {1} 2} at t = 0.48. Transition from mode {1} 2 to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.16. Transition from mode {2} to mode {1} 2 at t = 1.16. Transition from mode {2} to mode {1} 2 at t = 3. h = 20 mi: Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} 2 to mode {1} 2 at t = 1.1. Transition from mode {1} 2 to mode {1} 2 at t = 1.12. Transition from mode {2} to mode {1} 2 at t = 1.42. Transition from mode {2} to mode {1} 2 at t = 1.44. Transition from mode {1} 2 to mode {1} 2 at t = 1.54. Transition from mode {1} 2 at t = 3. Initialize in mode {0} to mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {2} to mode {3} at t = 3. Initialize in mode {4} at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {2} at t = 3. Initialize in mode {3} at t = 3. Initialize in mode {4} at t = 3. Initialize in mode {5} at t = 3. Initialize in mode {6} at t = 3. Initialize in mode {7} at t = 3. Initialize in mode {8} at t = 3. Initialize in mode {8} at t = 3. Initialize in mode {9} at t = 3. I						
 | | | (0) | |
 | | | | |
 | | | | | |
 | | | | |
 | |
Transition from mode {1} 2} to mode {2} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.16. Transition from mode {2} to mode {1} 2} at t = 1.16. Transition from mode {2} to mode {1} 2} at t = 1.16. Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} 2} at t = 1.1. Transition from mode {1} to mode {1} 2} at t = 1.1. Transition from mode {1} 2 to mode {1} 2 at t = 1.42. Transition from mode {1} 2 to mode {1} 2 at t = 1.42. Transition from mode {1} 2 to mode {1} 2 at t = 1.54. Transition from mode {1} 2 at t = 3. Initialize in mode {0}. Transition from mode {1} 2 at t = 3. Initialize in mode {0}. Transition from mode {1} 2 at t = 1.54. Transition from mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {2} at t = 3. Initialize in mode {3} at t = 3. Initialize in mode {4} at t = 3. Initialize in mode {1} at t = 3. Initialize in mode {2} at t = 3. Initialize in mode {3} at t = 3. Initialize in mode {4} at t = 1.7. Initialize in mode {3} at t = 3. Initialize in mode {4} at t = 1.7. Initialize in mode {3} at t = 3. Initialize in mode {4} at t = 1.7. Initialize in mode {1} at t = 1.7. Initialize in mode {2} at t = 3. Initialize in mode {3} at t = 3. Initialize in mode {4} at t = 3. Initialize in mode {5} at t = 3. Initialize in mode {6} at t = 3. Initialize in mode {6} at t = 3. Initialize in mode {6} at t = 3. In					
 | | | | - |
 | | | | 10 |
 | | | | | | |
 | | | | |
 | |
| Transition from mode {1} to mode {2} at t = 1. Transition from mode {2} to mode {1} 2} at t = 1.16. Terminate in mode {1} 2} at t = 3. h 20mi Initialize in mode {0}. Transition from mode {2} to mode {1} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} 2} at t = 1.12. Transition from mode {1} 2\to mode {1} at t = 1.12. Transition from mode {1} 2\to mode {1} at t = 1.42. Transition from mode {1} 2\to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.54. Transition from mode {1} 2\to at t = 3. Initialize in mode {0}. Transition from mode {1} to mode {1} at t = 1.54. Transition from mode {1} to mode {1} at t = 1.54. Transition from mode {1} to mode {1} at t = 1.54. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.62. Transition from mode {1} to mode {1} at t = 1.62. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {2} to mode {1} at t = 1.63. Transition from mode {2} to mode {1} at t = 1.63. Transition from mode {2} to mode {1} at t = 1.63. Transition from mode {2} to mode {1} at t = 1.63. Transition from mode {2} to mode {1} at t = 1.7. Transition from mode {1} at t = 1.7. Transition from mode {1} at t = 3. | | | | | |
 | - | | | - | _
 | | | | | | |
 | | | | | | |
 | | | | |
 | |
Terminate in mode {1 2} at t = 3. h 20ms: Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1 2} to mode {1 2} at t = 1.1. Transition from mode {1 2} to mode {2 at t = 1.12. Transition from mode {1 2} to mode {1 2 at t = 1.42. Transition from mode {1 2} to mode {1 2 at t = 1.44. Transition from mode {1 2} at t = 3. Initialize in mode {0}. Transition from mode {1 2} at t = 3. Initialize in mode {0}. Transition from mode {2} to mode {1 at t = 0.52. Transition from mode {2} to mode {1 at t = 0.52. Transition from mode {2} to mode {1 at t = 1.45. Transition from mode {2} to mode {1 at t = 1.45. Transition from mode {2} to mode {1 at t = 1.45. Transition from mode {2} to mode {1 at t = 1.62. Transition from mode {2} to mode {1 at t = 1.62. Transition from mode {2} to mode {1 2 at t = 1.63. Transition from mode {2} to mode {1 2 at t = 1.69. Transition from mode {2} to mode {1 2 at t = 1.69. Transition from mode {1 2 to mode {1 2 at t = 1.70. Transition from mode {1 2 to mode {1 2 at t = 1.70. Transition from mode {1 2 to mode {1 2 at t = 1.70. Transition from mode {1 2 to mode {1 2 at t = 1.70. Terminate in mode {1 2 at t = 3. The count based simulation has a let were contact travities a never travities to never travities to the line stepping in m. The creat based sim give fails to add the ball of the ball						
 | | | | |
 | | | | |
 | | | | | |
 | | | | |
 | |
| Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} 2 at t = 1.1. Transition from mode {1} 2 to mode {1} 2 at t = 1.1. Transition from mode {2} to mode {1} 2 at t = 1.4. Transition from mode {1} 2 to mode {1} 2 at t = 1.44. Transition from mode {1} 2 to mode {1} 2 at t = 1.54. Transition from mode {1} 2 to mode {1} 2 at t = 1.54. Transition from mode {1} 2 at t = 3. Initialize in mode {0}. Transition from mode {1} to mode {2} at t = 0.42. Transition from mode {1} to mode {2} at t = 0.42. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {1} to mode {2} at t = 1.62. Transition from mode {1} to mode {2} at t = 1.62. Transition from mode {1} 2 to mode {1} 2 at t = 1.63. Transition from mode {1} 2 to mode {1} 2 at t = 1.69. Transition from mode {1} 2 to mode {1} 2 at t = 1.71. Transition from mode {1} 2 to mode {1} 2 at t = 1.71. Transition from mode {1} 2 to mode {1} 2 at t = 1.71. Transition from mode {1} 2 at t = 3. | | | | | |
 | | | | | 2}
 | at | t : | = 1. | 16. | | |
 | | | | | | |
 | | | | |
 | |
| Initialize in mode {0}. Transition from mode {2} to mode {1} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} 2 at t = 1.1. Transition from mode {2} to mode {1} 2 at t = 1.12. Transition from mode {2} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.54. Terminate in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {2} at t = 1.62. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} 2 to mode {1} 2 at t = 1.63. Transition from mo | 7 | Γerm | inat | e in | mod | le {1
 | . 2} | at | t = | 3. | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Initialize in mode {0}. Transition from mode {2} to mode {1} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} 2 at t = 1.1. Transition from mode {2} to mode {1} 2 at t = 1.12. Transition from mode {2} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.54. Terminate in mode {1} 2 at t = 3. Initialize in mode {1} 2 at t = 3. Initialize in mode {1} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {2} at t = 1.62. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} 2 to mode {1} 2 at t = 1.63. Transition from mo		٠.			
 | _ | _ | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} 2) at t = 1.1. Transition from mode {2} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} 2) at t = 1.42. Transition from mode {1} 2) to mode {1} 2) at t = 1.42. Transition from mode {1} 2) to mode {1} 2) at t = 1.54. Terminate in mode {1} 2) at t = 3. Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {2} at t = 1.62. Transition from mode {1} to mode {1} 2 at t = 1.63. Transition from mode {2} to mode {1} at t = 1.63. Transition from mode {2} to mode {1} at t = 1.69. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Terminate in mode {1} 2 at t = 3.	10	MS :			
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} 2) at t = 1.1. Transition from mode {2} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} 2) at t = 1.42. Transition from mode {1} 2) to mode {1} 2) at t = 1.42. Transition from mode {1} 2) to mode {1} 2) at t = 1.54. Terminate in mode {1} 2) at t = 3. Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {2} at t = 1.62. Transition from mode {1} to mode {1} 2 at t = 1.63. Transition from mode {2} to mode {1} at t = 1.63. Transition from mode {2} to mode {1} at t = 1.69. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Terminate in mode {1} 2 at t = 3.					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} 2 at t = 1.1. Transition from mode {2} to mode {1} 2} at t = 1.1. Transition from mode {2} to mode {1} 2 at t = 1.42. Transition from mode {2} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} 2 at t = 1.54. Terminate in mode {1} 2} at t = 3. Initialize in mode {1} 2} at t = 3. Initialize in mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {2} to mode {1} at t = 1.62. Transition from mode {1} to mode {1} 2 at t = 1.63. Transition from mode {2} to mode {1} 2 at t = 1.63. Transition from mode {2} to mode {1} 2 at t = 1.63. Transition from mode {1} 2 to mode {2} at t = 1.71. Transition from mode {1} 2 to mode {1} 2 at t = 1.71. Transition from mode {1} 2 to mode {1} 2 at t = 1.71. Terminate in mode {1} 2 at t = 3.					
 | | | | (0. |
 | | _ | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {1} to mode {1} 2} at t = 1.1. Transition from mode {1} 2} to mode {2} at t = 1.12. Transition from mode {1} 2} to mode {1} 2} at t = 1.42. Transition from mode {1} 2} to mode {1} 2 at t = 1.42. Transition from mode {1} 2} to mode {1} 2 at t = 1.54. Transition from mode {1} to mode {1} 2} at t = 1.54. Terminate in mode {1} 2} at t = 3. Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.12. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.62. Transition from mode {1} to mode {1} 2 at t = 1.63. Transition from mode {1} 2} to mode {1} 2 at t = 1.69. Transition from mode {1} 2 to mode {1} 2 at t = 1.69. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.7. Transition from mode {1} 2 to mode {1} 2 at t = 1.60. Transition from mode {1} 2 to mode {1} 2 at t = 1.60. Transition from mode {1} 2 to mode {1} 2 at t = 1.60. Transition from mode {1} 2 to mode {1} 2 at t = 1.60. Transition from mode {1} 2 at t = 1.60. Transition from mode {1} 2 at t = 1.7. Transition from					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {1 2} to mode {2} at t = 1.12. Transition from mode {1 2} to mode {1 2} at t = 1.42. Transition from mode {1 2} to mode {1 3} to mode {1 4 t = 1.44. Transition from mode {1 2} at t = 1.54. Terminate in mode {1 2} at t = 3. Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.63. Transition from mode {1} 2 to mode {1} at t = 1.63. Transition from mode {2} to mode {1} at t = 1.69. Transition from mode {2} to mode {1} at t = 1.71. Terminate in mode {1} to mode {1} at t = 1.71. Terminate in mode {1} 2 at t = 3.					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {2} to mode {1 2} at t = 1.42. Transition from mode {1 2} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.54. Terminate in mode {1} 2} at t = 3. Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.62. Transition from mode {1} to mode {1} at t = 1.62. Transition from mode {1} 2} to mode {1} at t = 1.63. Transition from mode {1} 2 to mode {1} at t = 1.63. Transition from mode {1} 2 to mode {1} at t = 1.7. Transition from mode {1} to mode {1} at t = 1.7. Transition from mode {1} at t = 3.					
 | | | | 150 |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {1} to mode {1} 2} at t = 1.54. Terminate in mode {1} 2} at t = 3. Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.62. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} 2} to mode {2} at t = 1.63. Transition from mode {1} 2} to mode {1} 2) at t = 1.69. Transition from mode {1} 2} to mode {1} at t = 1.7. Transition from mode {1} 2} at t = 1.71. Terminate in mode {1} 2} at t = 3.					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Terminate in mode {1 2} at t = 3. Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.62. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {2} to mode {1} 2) at t = 1.69. Transition from mode {1} 2) to mode {1} 2) at t = 1.69. Transition from mode {1} 2) to mode {1} 2) at t = 1.71. Transition from mode {1} 2) to mode {1} 2) at t = 1.71. Terminate in mode {1} 2} at t = 3.					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
| Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} 2} at t = 1.62. Transition from mode {1} 2b to mode {1} 2b at t = 1.63. Transition from mode {2} to mode {1} 2b at t = 1.69. Transition from mode {1} 2b to mode {1} 2b at t = 1.70. Transition from mode {1} 2b to mode {1} 2b at t = 1.70. Transition from mode {1} 2b at t = 1.71. Terminate in mode {1} 2b at t = 3. | | | | | |
 | | | | | 2}
 | at | t : | = 1. | 54. | | |
 | | | | | | |
 | | | | |
 | |
| Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.2. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} 2} at t = 1.62. Transition from mode {1} 2} to mode {1} 2} at t = 1.63. Transition from mode {1} 2} to mode {1} 2} at t = 1.69. Transition from mode {2} to mode {1} 2} at t = 1.70. Transition from mode {1} 2} to mode {1} 2} at t = 1.71. Terminate in mode {1} 2} at t = 3. | | erm | ınat | e in | moo | e {1
 | 2} | at | ι = | ٥. | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.2. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} 2} at t = 1.62. Transition from mode {1} 2} to mode {1} 2} at t = 1.63. Transition from mode {1} 2} to mode {1} 2} at t = 1.69. Transition from mode {2} to mode {1} 2} at t = 1.70. Transition from mode {1} 2} to mode {1} 2} at t = 1.71. Terminate in mode {1} 2} at t = 3.					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} 2} at t = 1.62. Transition from mode {1} 2} to mode {1} 2} at t = 1.63. Transition from mode {1} 2} to mode {1} 2} at t = 1.69. Transition from mode {2} to mode {1} 2} at t = 1.7. Transition from mode {1} 2} to mode {1} 2} at t = 1.7. Transition from mode {1} 2} at t = 1.71. Terminate in mode {1} 2} at t = 3.					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} 2} at t = 1.62. Transition from mode {1} 2} to mode {1} 2} at t = 1.63. Transition from mode {1} 2} to mode {1} 2} at t = 1.69. Transition from mode {2} to mode {1} 2} at t = 1.7. Transition from mode {1} 2} to mode {1} 2} at t = 1.7. Transition from mode {1} 2} at t = 1.71. Terminate in mode {1} 2} at t = 3.	4.5				
 | - | + | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
| Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} 2} at t = 1.62. Transition from mode {1} 2} to mode {2} at t = 1.63. Transition from mode {2} to mode {1} 2} at t = 1.69. Transition from mode {1} 2} to mode {1} 2at t = 1.69. Transition from mode {1} 2} to mode {1} 2at t = 1.71. Transition from mode {1} 2} at t = 1.71. Terminate in mode {1} 2} at t = 3. | 10, | MS . | | | | \vdash
 | _ | _ | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
| Transition from mode {0} to mode {2} at t = 0.42. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} 2} at t = 1.62. Transition from mode {1} 2} to mode {2} at t = 1.63. Transition from mode {2} to mode {1} 2} at t = 1.69. Transition from mode {1} 2} to mode {1} 2at t = 1.69. Transition from mode {1} 2} to mode {1} 2at t = 1.71. Transition from mode {1} 2} at t = 1.71. Terminate in mode {1} 2} at t = 3. | | | | | | Щ
 | | | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
| Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.62. Transition from mode {1} 2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.69. Transition from mode {2} to mode {1} 2} at t = 1.7. Transition from mode {1} 2} to mode {1} 2at t = 1.7. Transition from mode {1} to mode {1} 2} at t = 1.7. Terminate in mode {1} 2} at t = 3. | | | | | |
 | | +- | mode | (n) | ۱
 | + | _ ^ | 42 | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} 2 at t = 1.62. Transition from mode {1} 2 to mode {2} at t = 1.63. Transition from mode {2} to mode {1} 2 at t = 1.69. Transition from mode {1} 2 to mode {1} 2 at t = 1.70. Transition from mode {1} to mode {1} 2 at t = 1.71. Transition from mode {1} to mode {1} 2 at t = 1.71. Terminate in mode {1} 2 at t = 3.					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} 2} at t = 1.62. Transition from mode {1} 2} to mode {2} at t = 1.63. Transition from mode {2} to mode {1} 2} at t = 1.69. Transition from mode {2} to mode {1} at t = 1.70. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} 2} at t = 1.71. Terminate in mode {1} 2} at t = 3.					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {1 2} to mode {2} at t = 1.63. Transition from mode {2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1} at t = 1.7. Transition from mode {1 2} to mode {1 2} at t = 1.71. Terminate in mode {1 2} at t = 3. The count based simulation has a lot more contact transitions of never transitions to \$\frac{1}{1},\frac{2}{3} as opposed to the time stepping sim. The creat based sim also fails to end of the pall @ both constraints which violates the system constraints. The time stepping sim does not					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1} at t = 1.7. Transition from mode {1} to mode {1 2} at t = 1.71. Terminate in mode {1 2} at t = 3. The went hased simulation has a lot more contact transitions of never transitions to {1,23 as opposed to the time stepping sime. The event based sime also fails to end of the pall @ both constraints which violates the system constraints. The time stepping sime does not					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {1 2} to mode {1} at t = 1.7. Transition from mode {1} to mode {1 2} at t = 1.71. Terminate in mode {1 2} at t = 3. The went based simulation has a lot more contact transitions of never transitions to \[\frac{1}{1}, \frac{2}{3} \] as opposed to the time stepping sim. The event based sim also tails to end of the pall @ both constraints which violates the system constraints. The time stepping sim does not					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Transition from mode {1} to mode {1} 2} at t = 1.71. Terminate in mode {1} 2} at t = 3. The went based simulation has a lot more contact transitions of never transitions to {1,2} as opposed to the time stepping sim. The event based sim also fails to end of the ball @ both constraints which violates the system constraints. The time stepping sim does not					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
Terminate in mode {1 2} at t = 3. The count based simulation has a lot more contact transitions of never transitions to \{1,2\}\} as opposed to the time stepping sim. The event based sim also tails to end of the ball @ both constraints which violates the system constraints. The time stepping sim does not					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
The crent based simulation has a lot more contact transitions of never transitions to \$1,23 as opposed to the time stepping sim. The crent based sim also fails to end of the pall @ both constraints which violates the system constraints. The time stepping sim does not					
 | | | | 3. |
 | | | | |
 | | | | | | |
 | | | | |
 | |
| \$1,23 as opposed to the time stepping sim. The event based sim also fails to end of the pall @ both constraints which violates the system constraints. The time stepping sim does not | | | | | | 1 1
 | | | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
\$1,23 as opposed to the time stepping sim. The event based sim also fails to end of the pall @ both constraints which violates the system constraints. The time stepping sim does not	_				
 | + | + | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
| \$1,23 as opposed to the time stepping sim. The event based sim also fails to end of the ball @ both constraints which violates the system constraints. The time stepping sim does not | | | | | | \vdash
 | _ | - | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
| \$1,23 as apposed to the time stepping sim. The event based sim also fails to end of the ball @ both constraints which violates the system constraints. The time stepping sim does not | | The | W | ent | has | ed
 | Jimi | Nati | 000 | Nas | a
 | lot | M | re | Con | act
 | tre | ~°ı | hons | 4 n | ever | · h | حمح
 | ition | دہ | 40 | |
 | |
pall @ both constraints which violates the system constraints. The time stepping sim does not					
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
 | | h | a. · | |
 | رٌ أ | 1 | | |
 | | | T. | | | |
 | - | | | _ |
 | |
| violate any of the constraints @ any point. | | pa | 6 | | |
 | | | | |
 | | | shr | Teve | Can
 | LILDY! | NTJ. | 100 | Time | 174 | MI J | Sil
 | n | له حا | 710 | • |
 | |
| | \perp | | 1 | 1 | of | tru
 | cons | train | +3 6 | ,م ف | 'y i
 | P*1~1 | | | | | |
 | | | | | | |
 | | | | |
 | |
| | | | late | an | |
 | | | | | l '
 | | | | | | |
 | | | | | | |
 | | | | |
 | |
			late	an	
 | _ | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
			late	any	
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
			late	any	
 | | | | |
 | | | | |
 | | | | | 1 | |
 | | | | |
 | |
			late	any	
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
			late	any	
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
			late	any	
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
			late	any	
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
			late	any	
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
			late	any	
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
			late	any	
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
			late	any	
 | | | | |
 | | | | |
 | | | | | | |
 | | | | |
 | |
| | | impumay r any c | impulse o may not m any differed any differe | impulse over to may not meet a any differences - 40 ms: Initiali Transiti | impulse over the timay not meet all of any differences between the second in the secon | impulse over the time st may not meet all of the re any differences between to Initialize in mo Transition from Transition fr | impulse over the time step (a may not meet all of the require any differences between these any differences between these are | impulse over the time step (as we may not meet all of the requirement any differences between these and to differences decrease differences decrease differences decrease decr | impulse over the time step (as we cannow may not meet all of the requirements for any differences between these and the evaluation of the requirements for any differences between these and the evaluation of the requirements for any differences between these and the evaluation of the property of the pr | impulse over the time step (as we cannot difmay not meet all of the requirements for the dany differences between these and the event-by differences between the event-by differences between these and the event-by differences between the eve | impulse over the time step (as we cannot different may not meet all of the requirements for the doma any differences between these and the event-based with the content of | impulse over the time step (as we cannot differentiate may not meet all of the requirements for the domain D any differences between these and the event-based simulation of the mode and the event-based simulation of the word of the content of the | impulse over the time step (as we cannot differentiate bet may not meet all of the requirements for the domain D_I in any differences between these and the event-based simulating differences diff | impulse over the time step (as we cannot differentiate between may not meet all of the requirements for the domain D_I in the any differences between these and the event-based simulation. Initialize in mode {0}. Transition from mode {0} to mode {1} 2} at t = 0 Transition from mode {2} to mode {1} 2 at t: Transition from mode {1} to mode {2} at t = 1 Transition from mode {1} to mode {2} at t = 3. Initialize in mode {0}. Transition from mode {1} to mode {2} at t = 0 Transition from mode {1} to mode {1} at t: Transition from mode {1} to mode | impulse over the time step (as we cannot differentiate between the may not meet all of the requirements for the domain D_I in the hybrical and differences between these and the event-based simulation. 2 40 ms. Initialize in mode {0}. Transition from mode {0} to mode {1} at t = 0.4. Transition from mode {1} to mode {1} at t = 0. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from mode {1} to mode {1} at t = 1. Transition from | impulse over the time step (as we cannot differentiate between these), may not meet all of the requirements for the domain D_I in the hybrid sy any differences between these and the event-based simulation. Fransition from mode {0}. Transition from mode {0} to mode {1} at t = 0.4. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.16. Terminate in mode {1} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.1. Transition from mode {1} to mode {2} at t = 1.1. Transition from mode {1} to mode {2} at t = 1.42. Transition from mode {1} to mode {2} at t = 1.42. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.45. Terminate in mode {1} to mode {2} at t = 1.54. Terminate in mode {1} to mode {2} at t = 1.54. Terminate in mode {1} to mode {2} at t = 1.69. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {1} to mode {2} at t = 1.62. Transition from mode {1} to mode {2} at t = 1.62. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.60. Transition from mode {1} to mode {1} at t = 1.71. Terminate in mode {1} to mode {1} at t = 1.71. Terminate in mode {1} at t = 3. | impulse over the time step (as we cannot differentiate between these), tho may not meet all of the requirements for the domain D_I in the hybrid syster any differences between these and the event-based simulation. 2 | impulse over the time step (as we cannot differentiate between these), though that not meet all of the requirements for the domain D_I in the hybrid system sen any differences between these and the event-based simulation. 2 40 ms: Initialize in mode {0}. Transition from mode {2} to mode {1} at t = 0.48. Transition from mode {1} 2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1. Transition from mode {1} to mode {2} at t = 1.16. Terminate in mode {1} to mode {2} at t = 1.16. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.1. Transition from mode {1} to mode {1} at t = 1.12. Transition from mode {1} to mode {1} at t = 1.42. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.45. Terminate in mode {1} to mode {1} at t = 1.45. Transition from mode {2} to mode {1} at t = 1.60. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.61. Transition from mode {1} to mode {1} at t = 1.61. Transition from mode {1} to mode {1} at t = 1.61. Transition from mode {1} to mode {1} at t = 1.61. Transition from mode {1} to mode {1} at t = 1.61. Transition from mode {1} to mode {1} at t = 1.61. Transition from mode {1} at t = 1.61. Tr | impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D_I in the hybrid system sense. any differences between these and the event-based simulation. 2 40ms: Initialize in mode {0}. Transition from mode {2} to mode {1} at t = 0.48. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1. Transition from mode {1} to mode {2} at t = 1.16. Terminate in mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.1. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {1} to mode {1} at t = 1.42. Transition from mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {2} to mode {2} at t = 1.12. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.69. Transition from mode {2} to mode {2} at t = 1.69. Transition from mode {2} to mode {1} at t = 1.71. Terminate in mode {1} at t = 3. | impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D_1 in the hybrid system sense, any differences between these and the event-based simulation. Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.16. Terminate in mode {1} to mode {2} at t = 1.16. Terminate in mode {1} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.45. Terminate in mode {1} at t = 3. | Impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D _I in the hybrid system sense. any differences between these and the event-based simulation. Initialize in mode {0}. Transition from mode {0} to mode {1} 2} at t = 0.48. Transition from mode {2} to mode {1} 2} at t = 0.48. Transition from mode {1} to mode {2} at t = 1. Transition from mode {2} to mode {1} 2} at t = 1.6. Terminate in mode {1} 2} at t = 3. Initialize in mode {0}. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.1. Transition from mode {1} to mode {2} at t = 1.1. Transition from mode {1} to mode {1} 2 at t = 1.1. Transition from mode {1} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.54. Terminate in mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.54. Terminate in mode {1} to mode {1} at t = 1.54. Transition from mode {2} to mode {1} at t = 1.54. Transition from mode {2} to mode {1} at t = 1.60. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {2} to mode {1} at t = 1.45. Transition from mode {2} to mode {1} at t = 1.60. Transition from mode {2} to mode {1} at t = 1.60. Transition from mode {2} to mode {1} at t = 1.60. Transition from mode {2} to mode {1} at t = 1.60. Transition from mode {2} to mode {1} at t = 1.60. Transition from mode {2} to mode {1} at t = 1.60. Transition from mode {2} to mode {1} at t = 1.60. Transition from mode {2} to mode {1} at t = 1.60. Transition from mode {2} to mode {1} at t = 1.70. Transition from mode {1} to mode {1} at t = 1.71. Terminate in mode {1} at t = 3. | impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D; in the hybrid system sense. any differences between these and the event-based simulation. 2 40 ms: Initialize in mode {0}. Transition from mode {1} to mode {2} at t = 0.4. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.16. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {0}. Transition from mode {0} to mode {2} at t = 1.1. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.1. Transition from mode {1} to mode {2} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.54. Terminate in mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.54. Transition from mode {1} to mode {2} at t = 1.69. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} to mode {1} at t = 1.71. Transition from mode {1} at | impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D _f in the hybrid system sense. any differences between these and the event-based simulation. Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {2} to mode {1 2} at t = 0.48. Transition from mode {1} to mode {2} at t = 0.52. Transition from mode {1} to mode {1 2} at t = 1.6. Transition from mode {1} to mode {1 2} at t = 1.16. Terminate in mode {0}. Transition from mode {0} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.12. Transition from mode {1} to mode {1} at t = 1.42. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.54. Terminate in mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.42. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.54. Terminate in mode {0}. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.62. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.63. Transition from mode {2} to mode {2} at t = 1.71. Terminate in mode {1} 2 at t = 1.71. | impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D _I in the hybrid system sense. any differences between these and the event-based simulation. Initialize in mode {0}. Transition from mode {2} to mode {1 2} at t = 0.4. Transition from mode {2} to mode {1 2} at t = 0.48. Transition from mode {2} to mode {1 2} at t = 1.16. Transition from mode {2} to mode {1 2} at t = 1.16. Terminate in mode {1 2} at t = 3. 20mi: Initialize in mode {0}. Transition from mode {2} to mode {1 2} at t = 1.12. Transition from mode {2} to mode {1 2} at t = 1.12. Transition from mode {2} to mode {1 2} at t = 1.12. Transition from mode {2} to mode {1 2} at t = 1.42. Transition from mode {1 2} to mode {1 2} at t = 1.44. Transition from mode {1 2} to mode {1 2} at t = 1.54. Terminate in mode {1 2} at t = 3. Initialize in mode {0}. Transition from mode {1 2} to mode {1 2} at t = 1.54. Terminate in mode {1 2} to mode {1 2} at t = 1.54. Terminate in mode {1 2} to mode {1 2} at t = 1.62. Transition from mode {2} to mode {1 2} at t = 1.62. Transition from mode {2} to mode {1 2} at t = 1.62. Transition from mode {1 2} to mode {1 2} at t = 1.62. Transition from mode {1 2} to mode {1 2} at t = 1.62. Transition from mode {1 2} to mode {1 2} at t = 1.63. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2} at t = 1.69. Transition from mode {1 2} to mode {1 2 | impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D_I in the hybrid system sense, any differences between these and the event-based simulation. Initialize in mode {0}. Transition from mode {2} to mode {1} 2 at t = 0.4. Transition from mode {2} to mode {1} 2 at t = 0.48. Transition from mode {1} to mode {2} at t = 1.6. Transition from mode {1} to mode {2} at t = 1.16. Terminate in mode {1} 2 at t = 3. **20 mi:* Initialize in mode {0}. Transition from mode {0} to mode {2} at t = 0.4. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.1. Transition from mode {1} to mode {1} at t = 1.1. Transition from mode {1} to mode {1} at t = 1.1. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 1.54. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.70. Terminate in mode {1} to mode {1} at t = 1.70. Terminate in mode {1} to mode {1} at t = 1.70. Terminate in mode {1} to mode {1} at t = 1.70. Terminate in mode {1} to mode {1} at t = 1.70. Terminate in mode {1} to mode {1} at t = 1.70. T | impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D_I in the hybrid system sense. any differences between these and the event-based simulation. Initialize in mode {0}. Transition from mode {2} to mode {1} 2 at t = 0.4. Transition from mode {2} to mode {1} 2 at t = 0.48. Transition from mode {1} to mode {2} at t = 1.6. Transition from mode {1} to mode {2} at t = 1.16. Terminate in mode {1} 2 at t = 3. **20 mi:** Initialize in mode {0}. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {3} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.1. Transition from mode {1} to mode {1} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.44. Transition from mode {2} to mode {1} at t = 1.44. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.42. Transition from mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {2} at t = 1.12. Transition from mode {1} to mode {2} at t = 1.13. Transition from mode {1} to mode {2} at t = 1.13. Transition from mode {1} to mode {2} at t = 1.13. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.70. Transition from mode {1} to mode {1} at t = 1.70. Transition from mode {1} to mode {1} at t = 1.70. Transition from mode {1} to mode {1} at t = 1.70. Transition from mode {1} to mode {1} at t = 1.70. Transition from mode {1} to mode {1} at t = 1.71. Terminate in mode {1} to mode {1} at t = 1.71. Terminate in mode {1} to mode {1} at t = 1.71. Terminate in mode {1} to mode {1} at t | impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D, in the hybrid system sense. any differences between these and the event-based simulation. 2 40ms: Initialize in mode {0}. Transition from mode {2} to mode {1} 23 at t = 0.48. Transition from mode {1} 2 to mode {1} 3 at t = 0.52. Transition from mode {1} 2 to mode {1} 2 at t = 1.16. Terminate in mode {0}. Transition from mode {2} to mode {1} 2 at t = 1.16. Transition from mode {2} to mode {1} 2 at t = 1.16. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {1} to mode {1} 2 at t = 1.12. Transition from mode {1} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.44. Transition from mode {1} to mode {1} 2 at t = 1.54. Terminate in mode {1} 2 to mode {1} at t = 1.42. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {2} at t = 1.54. Terminate in mode {1} to mode {2} at t = 1.54. Transition from mode {1} to mode {2} at t = 1.60. Transition from mode {1} to mode {2} at t = 1.60. Transition from mode {1} to mode {2} at t = 1.60. Transition from mode {1} to mode {2} at t = 1.60. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.69. Transition from mode {1} to mode {1} at t = 1.69. Transition from mode {1} to mode {1} at t = 1.69. Transition from mode {1} to mode {1} at t = 1.69. Transition from mode {1} to mode {1} at t = 1.69. Transition from mode {1} to mode {1} at t = 1.69. Transition from mode {1} to mode {1} at t = 1.69. Transition from mode {1} to mode {1} at t = 1.69. Transition from mode {1} to mode {1} at t = 1.69. Transition from mode {1} at t = 3. Transition from mo | impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D _I in the hybrid system sense, any differences between these and the event-based simulation. = 40 m _S : Initialize in mode {0}. Transition from mode {2} to mode {1} 2 at t = 0.4. Transition from mode {1} to mode {1} 2 at t = 0.4s. Transition from mode {1} to mode {1} 2 at t = 1.6. Transition from mode {1} to mode {1} 2 at t = 1.6. Terminate in mode {0}. Transition from mode {2} to mode {1} at t = 0.52. Transition from mode {2} to mode {1} at t = 1.16. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {2} to mode {1} at t = 1.12. Transition from mode {1} to mode {1} 2 at t = 1.12. Transition from mode {1} to mode {1} 2 at t = 1.42. Transition from mode {1} to mode {1} 2 at t = 1.44. Transition from mode {1} to mode {1} 2 at t = 1.54. Transition from mode {1} to mode {1} 2 at t = 1.54. Terminate in mode {1} to mode {1} at t = 0.52. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {2} at t = 1.54. Terminate in mode {1} to mode {2} at t = 1.54. Terminate in mode {1} to mode {2} at t = 1.60. Transition from mode {2} to mode {3} at t = 1.60. Transition from mode {4} to mode {1} at t = 1.45. Transition from mode {1} to mode {2} at t = 1.7. Transition from mode {1} to mode {1} at t = 1.45. Transition from mode {1} to mode {2} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.63. Transition from mode {1} to mode {1} at t = 1.67. Transition from mode {1} to mode {1} at t = 1.7. Transition from mode {1} to mode {1} at t = 1.7. Transition from mode {1} to mode {1} at t = 1.7. Transition from mode {1} to mode {1} at t = 1.7. Terminate in mode {1} to mode {1} at t = 3. | impulse over the time step (as we cannot differentiate between these), though the may not meet all of the requirements for the domain D _f in the hybrid system sense. any differences between these and the event-based simulation. 2 |