

| Simcenter Madymo

Generic Seated Scooter Model

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General

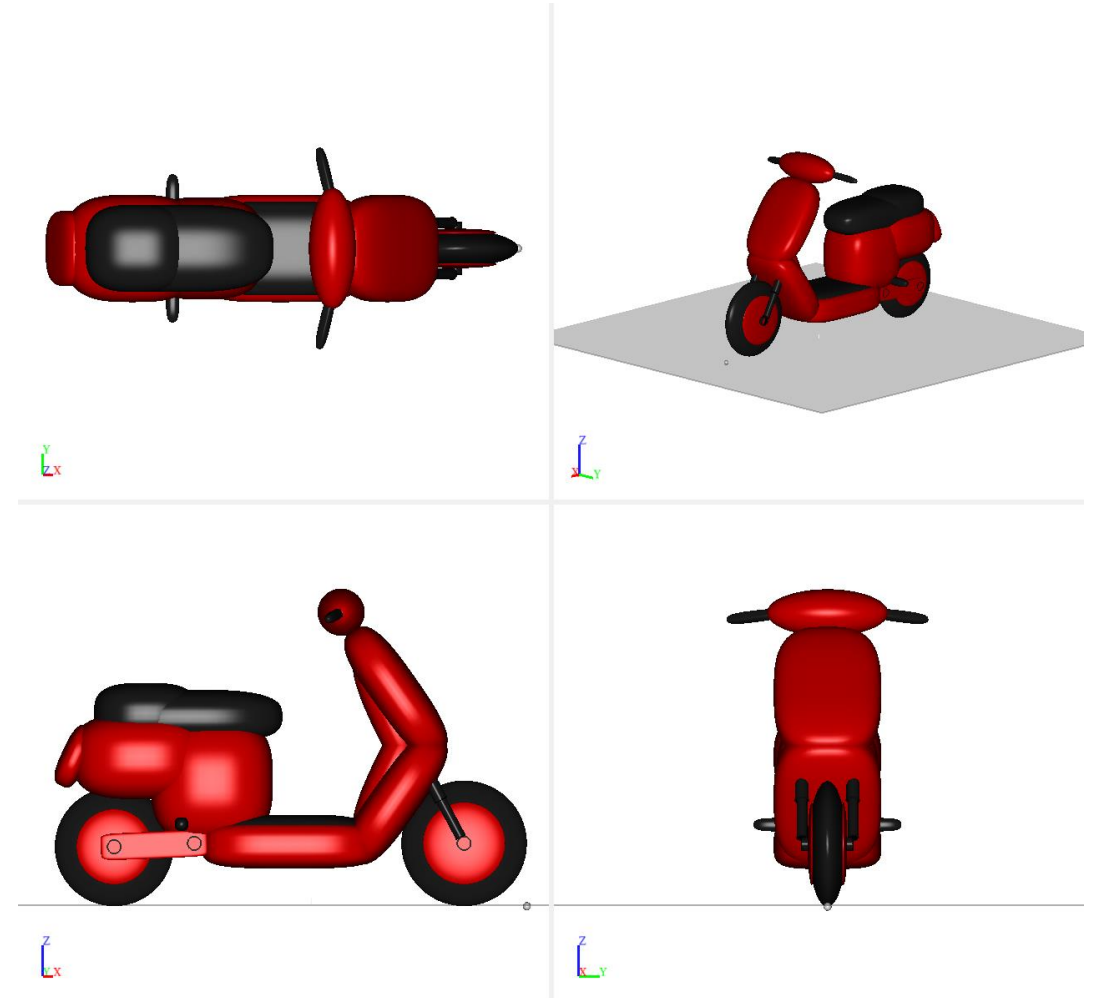
Scooter_seated_usr.xml

Purpose

- This model is meant to serve as a generic or baseline scooter model for injury risk assessment and/or accident analysis & reconstruction involving vulnerable road users (VRU), using Simcenter Madymo

Specifications

- Generic model – not validated against specific hardware
- Rigid body model with mass and geometry parametrized with DEFINE variables, all in SYSTEM.MODEL 'Scooter_sys'
- Model positioning and initialization parametrized with DEFINE variables (located in GROUP_DEFINE on root level)
- Model includes generic, non-encrypted and user-editable contact characteristics for the different scooter surfaces
- Comes with SYSTEM.MODEL 'Ground_sys', including parameterized ramp model that can be used to represent a speed bump, a curb, or even a rigid wall
- No model license encryption applied. License requirements are:
 - Simcenter Madymo multibody solver license (or 40 Madymo tokens)

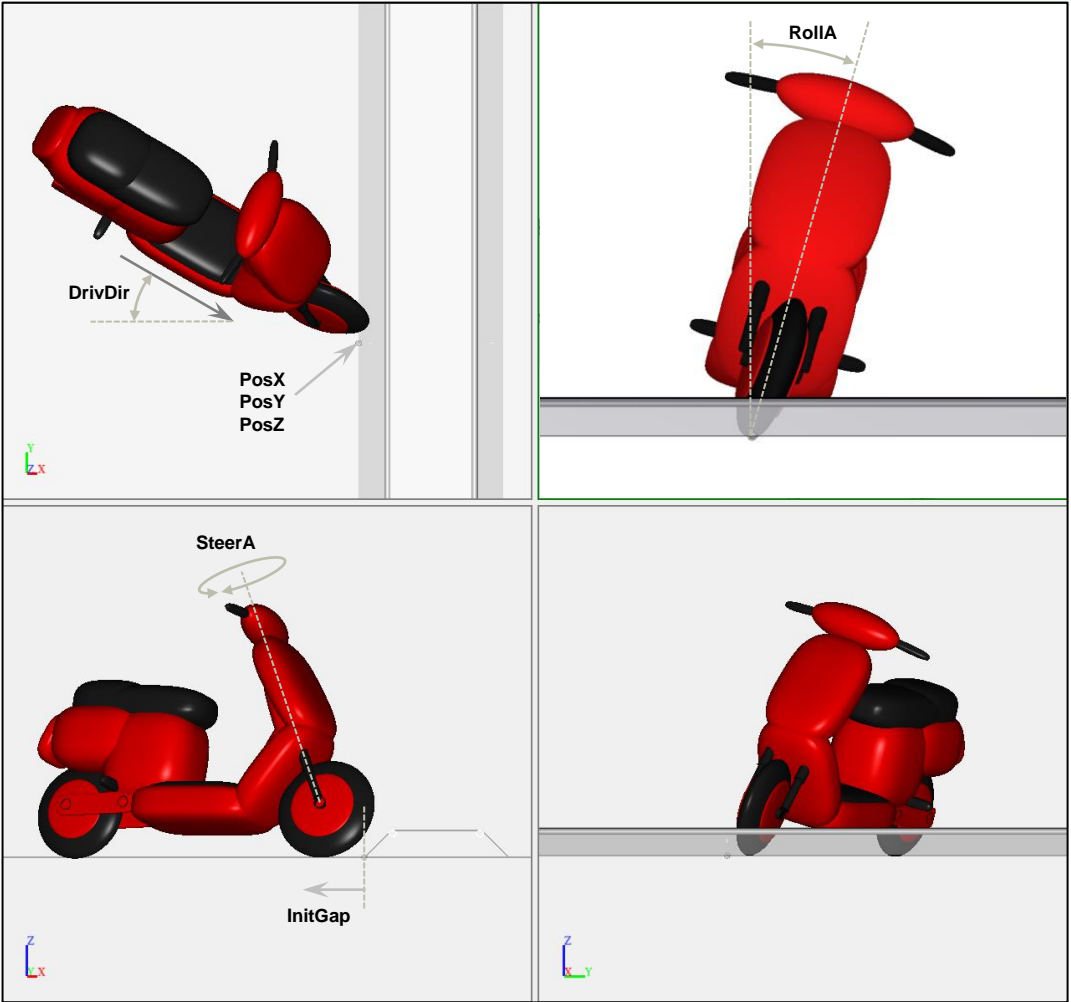
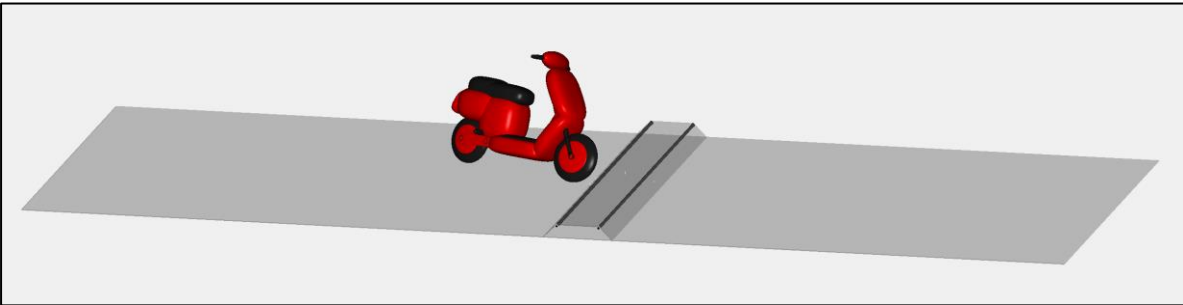


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Adjustable DEFINE variables – LoadcaseParameters_gde

Scooter_seated_usr.xml

picture code	measure description	DEFINE VAR_NAME	DEFINE VALUE	unit
---	Simulation start time	StartTime	0.000	s
---	Simulation end time	EndTime	3.000	s
---	Integration time step	TimeStep	1.0E-05	s
PosX	X-coordinate of scooter ref. pnt	ScooterPosX	0.000	m
PosY	Y-coordinate of scooter ref. pnt	ScooterPosY	0.000	m
PosZ	Z-coordinate of scooter ref. pnt	ScooterPosZ	0.000	m
DrivDir	Scooter driving direction	DrivingDirection	30	deg
---	Scooter driving speed	DrivingSpeed	15	kph
SteerA	Scooter steer angle	SteeringAngle	-10	deg
RollA	Scooter roll angle	RollAngle	-15	deg
InitGap	Scooter initial gap w.r.t. ref. pnt	InitialGap	0.000	m



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Adjustable DEFINE variables – Ground_sys

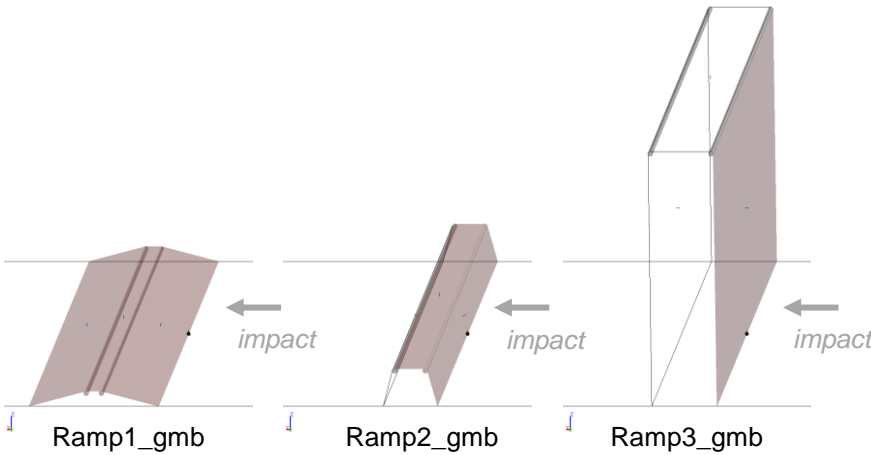
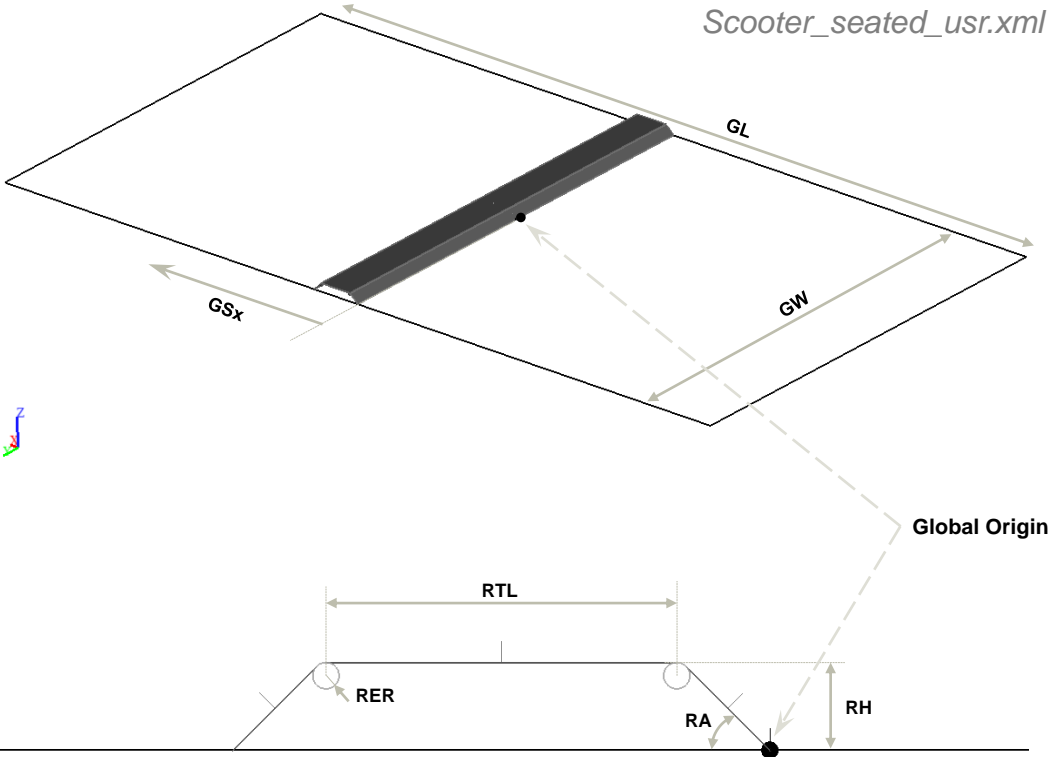
picture code	measure description	DEFINE VAR_NAME	DEFINE VALUE	unit
GW	Ground surface width *	GroundWidth	5.0	m
GL	Ground surface length *	GroundLength	10.0	m
GSx	Ground center X-shift (from origin)	GroundShiftX	0.0	m

RH	Ramp height	RampHeight	0.100	m
RTL	Ramp top surface length	RampTopLength	0.400	m
RA	Ramp angle	RampAngle	45	deg
RER	Ramp edge radius	RampEdgeRadius	0.015	m

* ground surface dimensions are for visualisation only, for contact definitions the ground surface is set as infinite (BOUNDARY_WIDTH=INF)

Remarks:

- The ramp edge cylinders have been included to enable proper contact interaction of multibody (wheel/tire) surfaces with the ramp edge during ramp impact.
- The ramp model is easily adjustable to represent a rigid wall, by simply increasing the ramp height and adjusting ramp angle to 90 degrees.
- Depending defined ramp geometry and load case, the user may use use a different *contact group* for contact definitions (as interference with the backside of far side ramp plane may need to be avoided):
 - ‘Ramp1_gmb’ complete ramp – all surfaces included use for longer, gradual ramps
 - ‘Ramp2_gmb’ near side + top of ramp (rear ramp & edge excluded) use for shorter, steep ramps
 - ‘Ramp3_gmb’ near side plane of ramp only use for wall representation

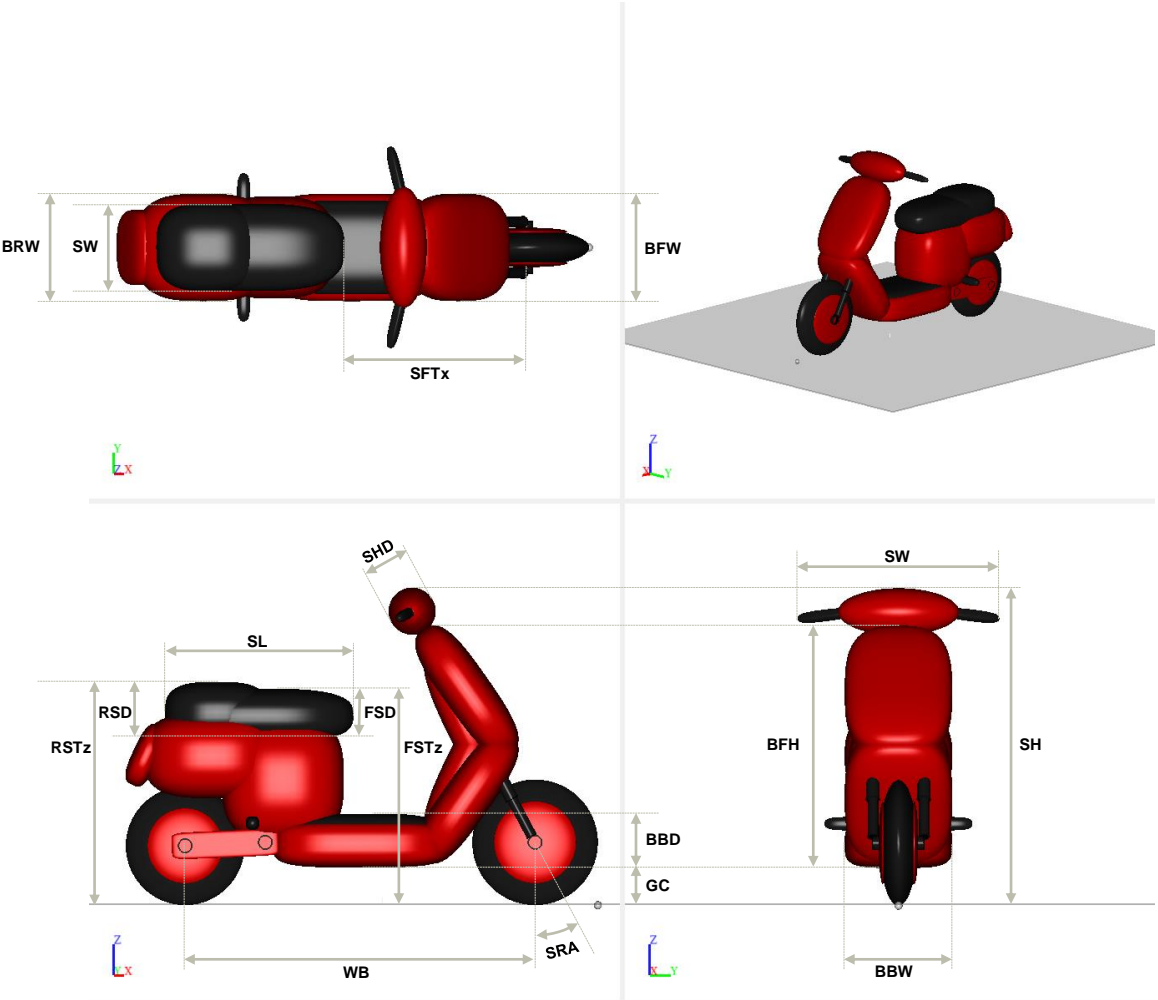


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Adjustable DEFINE variables – Scooter_sys

Scooter_seated_usr.xml

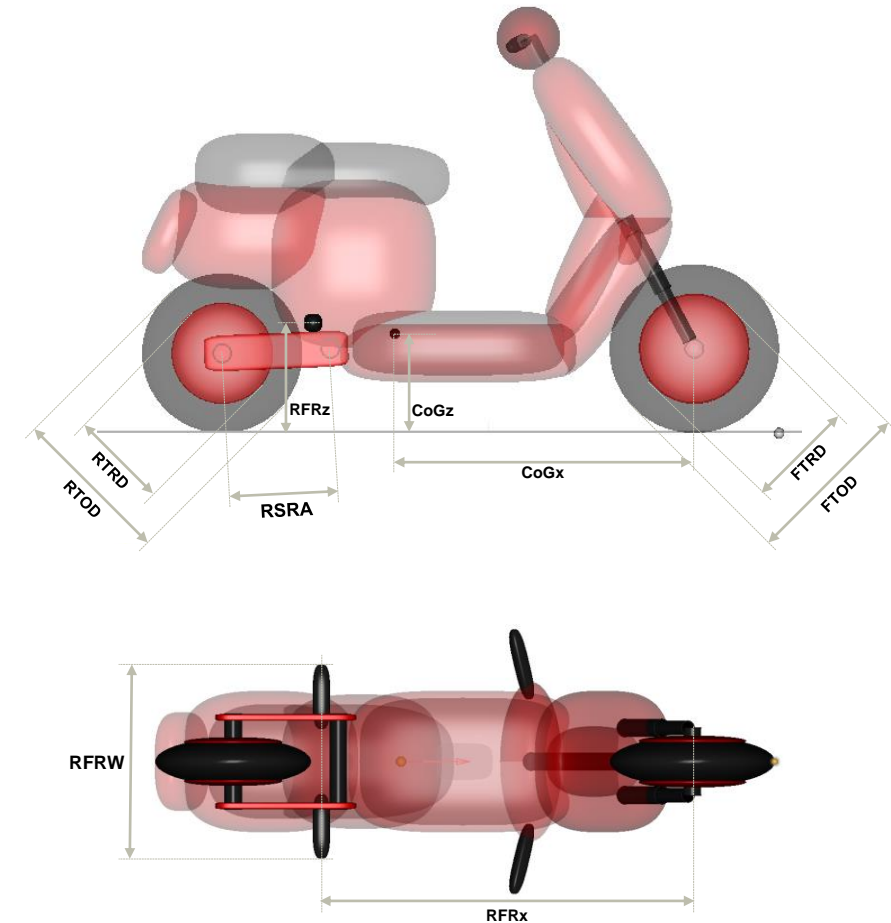
picture code	measure description	DEFINE VAR_NAME	DEFINE VALUE	unit
WB	Scooter wheelbase	WheelBase	1.300	m
GC	Floor to frame bottom surface	GroundClearance	0.135	m
BBD	Scooter body - base depth	BodyBaseDepth	0.200	m
BBW	Scooter body - base width	BodyBaseWidth	0.400	m
BFW	Scooter body - front width	BodyFrontWidth	0.400	m
BFH	Scooter body - front width	BodyFrontHeight	0.900	m
BRW	Scooter body – rear width	BodyRearWidth	0.400	m
SL	Length of saddle	SeatLength	0.700	m
SW	Width of saddle	SeatWidth	0.325	m
SFTx	Front axle to front of saddle	SeatFrontTipX	0.675	m
SFTz	Floor to top of front seat	SeatFrontTopZ	0.800	m
FSD	Depth of front seat	FrontSeatDepth	0.200	m
RSTz	Floor to top of rear seat	RearSeatTopZ	0.825	m
RSD	Depth of rear seat	RearSeatDepth	0.225	m
SH	Floor to top of steer hub	SteerHeight	1.175	m
SW	Scooter steer width	SteerWidth	0.750	m
SHD	Steer hub diameter (in X-Z plane)	SteerHubDiameter	0.175	m
SRA	Steer rake angle	SteerRakeAngle	28	deg
---	Steer rotation end stop angle	SteerEndStopAngle	45	deg



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Adjustable DEFINE variables – Scooter_sys

picture code	measure description	DEFINE VAR_NAME	DEFINE VALUE	unit
---	Scooter kerb weight	ScooterMass	125	kg
CoGx	Front axle to scooter CoG	ScooterCoG_X	0.825	m
CoGz	Floor to scooter CoG	ScooterCoG_Z	0.275	m
---	Front wheel mass	FrontWheelMass	4	kg
FTRD	Front tire rim diameter	FrontTireRimDiameter	0.305	m
FTOD	Front tire outer diameter	FrontTireOuterDiameter	0.467	m
---	Front tire width *	FrontTireWidth	0.090	m
---	Rear wheel mass	RearWheelMass	4	kg
RTRD	Rear tire rim diameter	RearTireRimDiameter	0.279	m
RTOD	Rear tire outer diameter	RearTireOuterDiameter	0.441	m
---	Rear tire width *	RearTireWidth	0.090	m
RSRA	Rear susp. joint to rear axle	RearSuspJntToRearAxle	0.298	m
RFRW	Rear footrest width	RearFootRestWidth	0.550	m
RFRx	Front axle to rear footrest	RearFootRestX	1.050	m
RFRz	Floor to rear footrest	RearFootRestZ	0.300	m
---	Frame color (HDF5 in MADPost)	FrameColor	Red3	-



- tire width DEFINE values used for moment of inertia calculations only, tire ellipsoid surfaces kept proportional to tire diameters.
- changing the scooter design parameters may sometimes require a bit of iterative adjustment to keep a consistent structure/geometry.

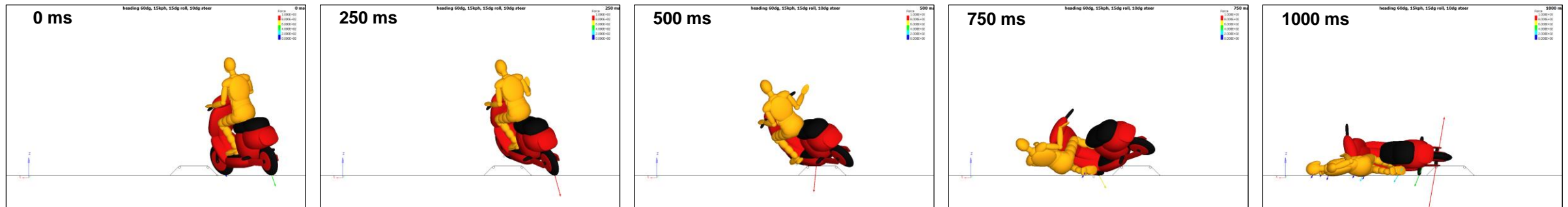
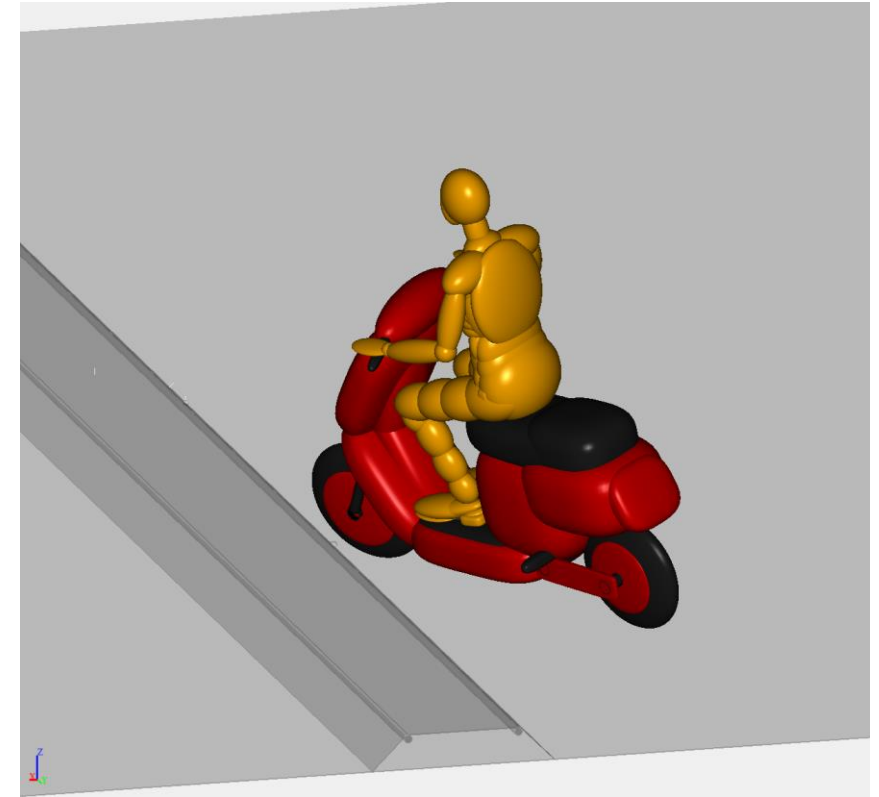
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Example application model

Load case example model 'Scooter_seated_PHBM-50M.xml'

- Scooter model with 50th percentile male driver (pedestrian HBM model)
- Scooter hitting ramp at 60° heading angle with speed of 15kph
- Approaching with -15° roll angle and -10° steer angle
- Model includes 'h_ped50el_inc.xml' from Madymo R2406 model library
- License requirements are:
 - Simcenter Madymo multibody solver license (or 40 Madymo tokens)
 - 20 tokens for Simcenter Madymo pedestrian human body model
- Animation of first 1000ms including contact vector display
 - MADPost session file included in package: 'Scooter_seated_PHBM-50M_madpost.mps'
 - Simulation throughput time ~ 1 minute per full second simulated event duration (running in serial mode on Intel Core i9-12950HX 2300 MHz processor)

Scooter_seated_PHBM-50M.xml



| Contact

Simcenter Madymo Customer Support

[Simcenter Madymo on Siemens Support Center](#) (login required)

madymo.support.sisw@siemens.com