# Working Model 2004 New Features\*

## Overview

- 1. Improved ability to create flexible bodies (Flexbeams)
- 2. FlexLM licensing
- 3. DC Motor and DC Actuator
- 4. Generic Coord-to-Coord Constraint
- 5. Generic Point-to-Point Constraint
- 6. DXF import expanded to version 12 through version 2000
- 7. Dynamic memory allocation for objects
- 8. Tutorial guide (PDF format) now included a \$50 value
- 9. Updated user interface
- **10. Improved graphing capabilities**
- 11. Instantaneous vector values can be displayed with vectors
- 12. Color of bodies linked to formula language and can change on the fly
- **13.** Feel the motion and/or collision

\* Runs on Microsoft<sup>®</sup> Windows<sup>®</sup> 95/98/98SE/Me/NT<sup>®</sup>4.0/2000/XP

#### 1. Improved ability to create flexible bodies (Flexbeams)

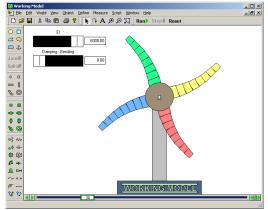
Significant new features have extended the popular Flexbeam script:

- Create flexible beams in bending mode, extension mode, or both
- Create flexible beams from rectangles and four-sided polygons (tapered beams) in any orientation
- Automatically heal polygons before creating flexible beams
- Re-attach constraints and points attached to the original body
- Create sliders for bending and/or extension stiffness and damping
- Significantly increase the maximum number of flexible beam elements
- Improve error checking

Flexbeam Type Bending		Number of Elements	(OK
EI = 30000	N*m^2	n = 50	Cancel
Extension			Help
EA = 2000	N	n = 10	

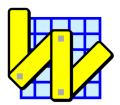
Flexbeam input dialog box

MSC.Software Tel: 800.766.6615 or 650.381.3395 Fax: 866.215.3457 or 650.574.7541 Web: http://www.workingmodel.com Email: wm2d.info@mscsoftware.com WM2004NewFeatures.pdf Last updated 04/08/2004 by Paul Mitiguy and Michael Woo



Sample Flexbeam output





### 2. FlexLM licensing

The flexibility of FlexLM licensing, e.g., network licensing across subnets, is added to Working Model 2004. New WM2004 license options include:

- Counted node-locked single-user license
- Multi-user license through a network server

Working Model 2004 also supports existing hardware dongle license options without additional charge. New or replacement hardware dongle license are available with additional charge. WM2004 also supports educational licensing with proof of full-time academic affiliation and use.



Licensing X
Select the License
C Serial Number
C Local FLEXIm
Floating Network FLEXIm
Host: server Port: 1700
OK Cancel

Licensing dialog box

#### **3. DC Motor and DC Actuator**

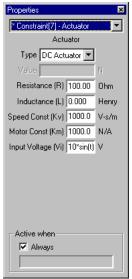
Model DC motors and DC actuators with the following input parameters:

- Motor Resistance (R)
- Motor Inductance (L)
- Motor Back-EMF Speed Constant (Kv)
- Motor Force/Torque Constant (Km)
- Motor Input Voltage (Vi)

The value of these parameters can be set with a number, slider, or any Working Model formula.

Properties 🗙				
* Constraint[3] - Motor				
Motor				
Type DC Motor 💌				
Value rad/s				
Resistance (R) 100.00 Ohm				
Inductance (L) 0.000 Henry				
Speed Const (Kv) 1000.0 V-s				
Motor Const (Km) 1000.0 N-m/A				
Input Voltage (Vi) input[3] V				
Base Point				
Point[4]				
Point				
Point[2]				
Active when				
✓ Always				

DC motor properties



DC actuator properties



#### 4. Generic Coord-to-Coord Constraint

• The Generic Coord-to-Coord **Pin** Constraint is a powerful tool for advanced users and is useful for combining properties and measurements of various torque-producing devices, including torsional springs, torsional dampers, torque motors, rotational friction, and torques.

Properties		×
* Constraint[7] - Generic Coord-I 💌	• Pin	O Slot
Generic Coord-to-Coord	🗹 Spring	🗖 Spring ———
Slot	Torque Kr	Force K x
Point[5] Angle 0.000 rad	K 10.000 N-m/rad	K 50.000 N/m
	Rotation 0.100 rad	Length 0.000 m
× 0.800 m	(current) 0.000 rad	(current) 0,000 m
y -0.400 m	Damper	🗖 Damper
- Point	Torque K s	Force K v
Point[6]	C 1.000 N-m-s/rad	C 1.000 N-s/m
x -1.250 m	Motor —	C Actuator
y 0.250 m	Type Torque	Type Length
	value 1.000 N-m	value 1.000 m
	Friction	Friction
	Coef. 0.500	Coef. 0.500
- Active when	Radius 0.000 m	
Always	Torque	Force
	1.000 N-m	1.000 N

Generic Coord-to-Coord Properties - Pin

• The Generic Coord-to-Coord **Slot** Constraint is a powerful tool for advanced users and is useful for combining properties and measurements of forces along slots, including dampers, actuators, friction, and forces.

Properties				×
* Constraint[7] - Generic Coord-I	— 🔿 Pin — — — — — — — — — — — — — — — — — — —		- 💿 Slot	
Generic Coord-to-Coord	🔽 Spring		🗖 Spring	
Slot	Torque K r	<b>T</b>	Force K x	~
Point[5]	K 10.000	N-m/rad	K 50.000	N/m
Angle 0.000 rad	Rotation 0.100	rad	Length 0.000	_
× 0.800 m	· · · · ·			m
y -0.400 m	(current) 0,000	rad	(current) 0,000	
, , , , , , , , , , , , , , , , , , ,	Damper		🔽 Damper ———	
- Point-	Torque K s	7	Force K v	-
Point[6]	C 1.000	N-m-s/rad	C 1.000	N-s/m
x -1.250 m	Motor		Actuator —	
y 0.250 m	Type Torque	~	Type Length	•
	value 1.000	N-m	value 1.000	m
	Friction		Friction	
	Coef. 0.500		Coef. 0.500	_
A alfana an hann	Radius 0.000	m		
Active when	Torque		Force	
	1.000	N-m	1.000	N
	1		1.000	

Generic Coord-to-Coord Properties - Slot

#### 5. Generic Point-to-Point Constraint

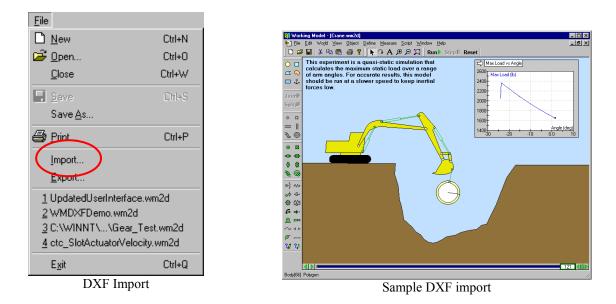
The Generic Point-to-Point Constraint is a powerful tool for advanced users and is useful for combining properties and measurements of rods, ropes, separators, springs, dampers, actuators, and forces.

Properties		×
* Constraint[3] - Generic	Point-ta 💌	
Generic Point-to-F	Point	✓ Spring
Rod		Force K x
Length 2.280	m	K 50.000 N/m
(current) 2.280	m	Length 2.280 m
Rope		(current) 2.280 m
Length 2.280	m	Damper
(current) 2.280	m	Force K v
Elasticity 0.000		C 1.000 N-s/m
Separator		Actuator
Length 2.280	m	Type Force
(current) 2.280	m	value 1.000 N
(current) c.coo		Force
Elasticity 0.000		0.000 N
Active when		
Always		

Generic Point-to-Point Properties

#### 6. DXF import expanded to version 12 through version 2000

Updated CAD DXF import now supports DXF versions 12, 13, 14, and 2000. In addition, DXF import automates certain conversions from arcs and line segments to polygons.



## 7. Dynamic memory allocation for objects

With dynamic memory allocation, the number of bodies, constraints, points, inputs, and output meters used in a simulation is limited only by your computer's memory.

## 8. Tutorial guide (PDF format) now included – a \$50 value

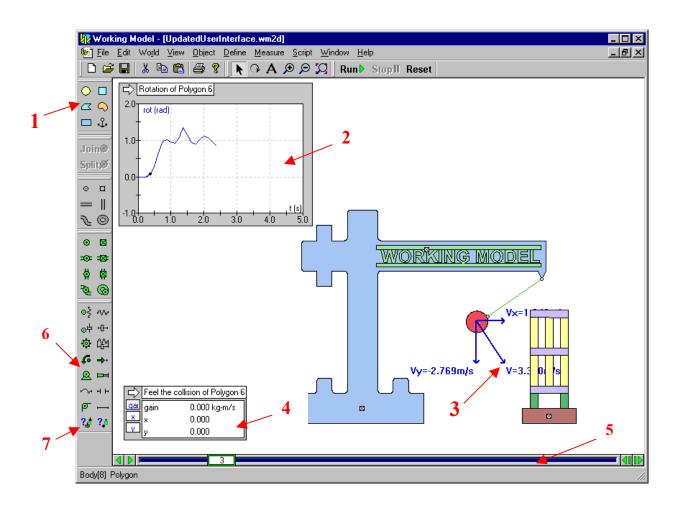
Working Model

The PDF version of the tutorial guide is now included on the Working Model CD. With nine comprehensive exercises that emphasize the fundamental tools of motion simulation technology, this tutorial guide takes the user from beginning concepts to building a functional working model. Topics include:

Introductory Demonstration	Double-slotted rod	Piston Engine
Cruise Control with MATLAB	Belt-Driven Camshaft	Scripting
Making Visually Appealing Models	Earthquake Simulation	Advanced Scripting

## 9. Updated user interface

- 1. New default colors for bodies
- 2. New graphs and graphing options
- 3. Vector values can be displayed with vectors
- 4. New meter for feeling motion and/or collision (requires a force-feedback mouse or joystick)
- 5. New colors in the Run toolbar
- 6. New DC motor and DC actuator
- 7. New generic joints



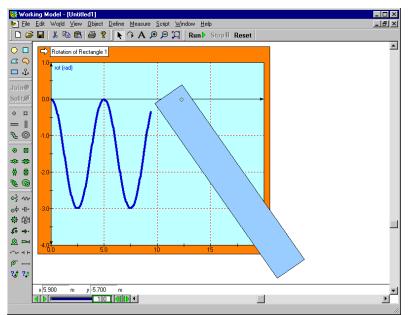
## 10. Improved graphing capabilities

New graphing capabilities allow you to control:

- Thickness of curves and lines
- Plot background and frame colors
- Scaling of curves and lines
- Display of X and/or Y axes, grid lines, or grid labels
- Grid line colors

Appearance					×
Show Label	Color Thick.	* Output[5] - Rota Rotation of Recta		ow ow name	
		✓ Frame	Plot:		,
		<ul><li>Labels</li><li>Units</li><li>Connect points</li></ul>	Frame: 🗾 🗸	Axes: 🔽 🔽 Grid: 🔽 🔽 Grid labels: 🔽 🔽	7

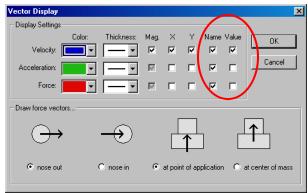
New: Appearance dialog box for graphs



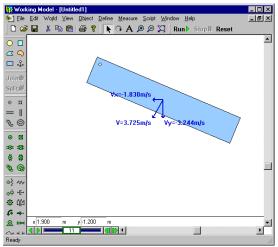
Showing a body's motion in an improved graph

#### 11. Instantaneous vector values can be displayed with vectors

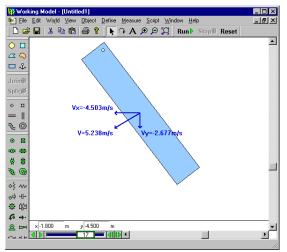
The value of various vectors and their components can be displayed on screen. The vector values change dynamically as the simulation runs and provides excellent visual feedback on the magnitude/direction characteristics of vectors.



Updated Vector Display dialog box



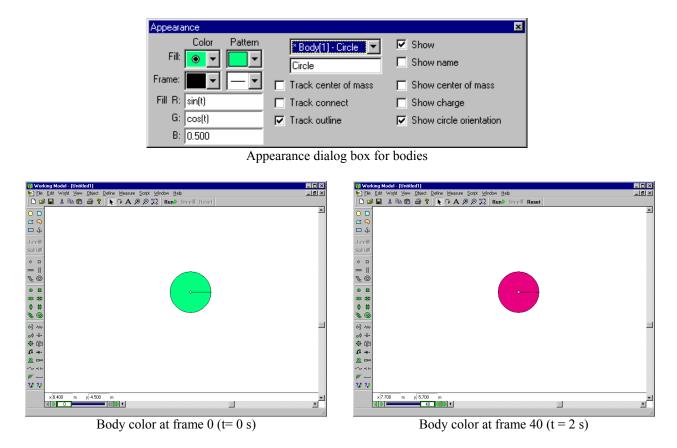
Instantaneous values shown with the vectors



Note: Vector values change as the simulation runs

#### 12. Color of bodies can be linked to a formula and vary with time, velocity, force, ...

Color of bodies can be controlled with the extensive Interactive Physics formula language. Enter constants, equations, conditions, etc., in the RGB components of the body color.



13. Feel the motion and/or collision (requires a force-feedback mouse or joystick)

Feel the motion and/or collision of bodies through a force-feedback mouse or joystick. Choose the default effect or an effect from the Immersion Studio library of mouse and sound effects.

Measure		
Position → Velocity → Agceleration → P-⊻-A →		
Center of Mass Position  Center of Mass Velocity Center of Mass Velocity  Momentum Angular Momentum Total Force Total Torgue Gravity Force	Feel the Collision/Motion         Image: Straight of the collision         Image: Straight of the collision	OK Cancel Help
Electrostatic Force Air Force Force Field Electrostatic Force Force Field Force field Feel the Collision Feel the Collision Field the Motion Kinetic Energy Gravity Potential	Alarms: acoga Alarms: acoga Alarms: astrohu Alarms: baump Alarms: beelelee Alarms: beeplit Alarms: beeplit Alarms: beenum Include sound	

Select Feel the Motion or Feel the collision

Choose haptics effects, volume, and response