NS *Materieel*

ADAMS/Rail - Verifications & Applications

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- Contact model
- Vehicle models & Results
- Conclusion

B. Application of ADAMS/Rail in VRA

(Vehicle Response Analysis)

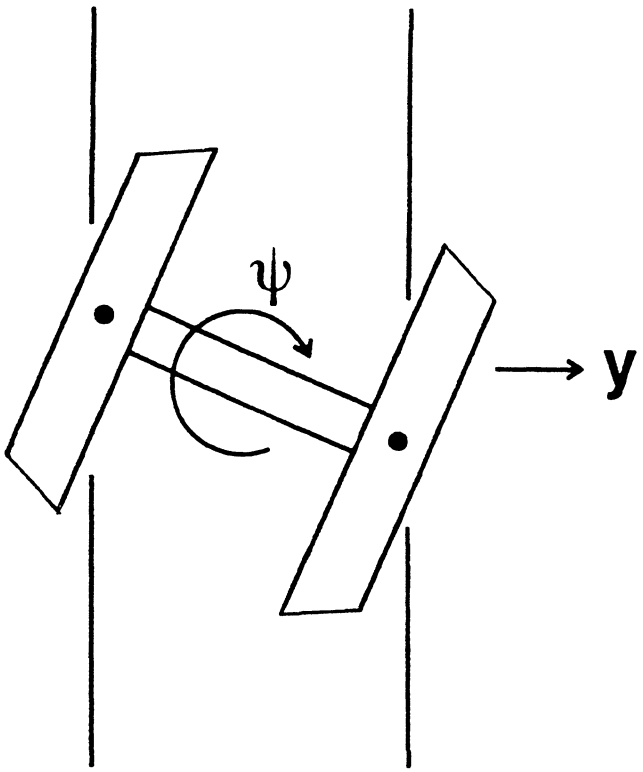
Verification -

Contact model

- Physical model
- Creep forces
- Calculation procedure

Contact model

- Physical model



* 2 D.O.F.: Lateral & Yaw

* Conical wheels

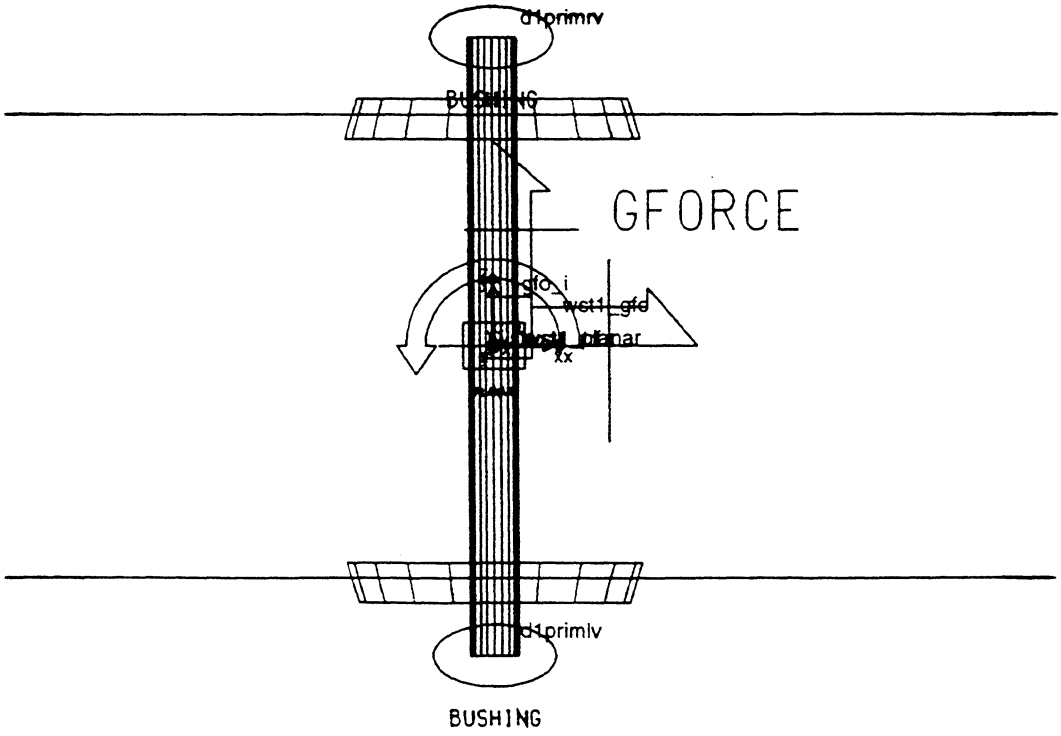
Contact model

- Creepforces Linear Kalker:

$$\underline{T}_{xj} = -\underline{f}_{11}\, \underline{v}_{xj}$$

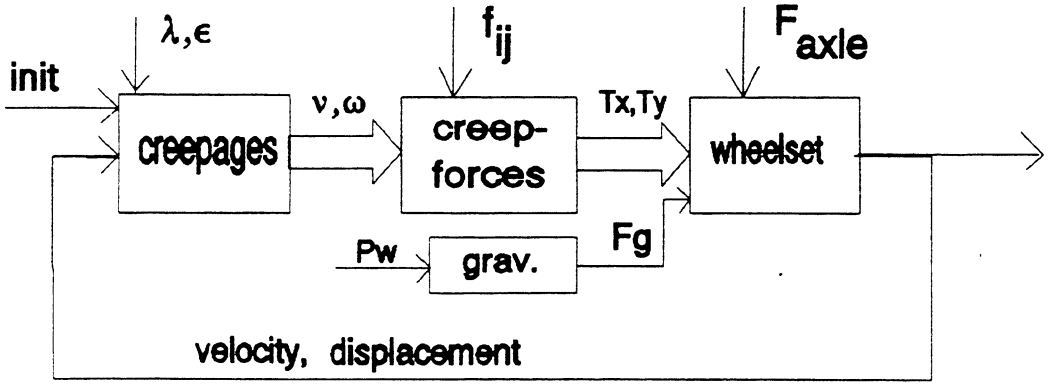
$$\underline{T}_{yj} = -\underline{f}_{22}\, \underline{v}_{yj} - \underline{f}_{23}\underline{\omega}_{zj}$$

- Application of the forces:



Contact model

- Calculation procedure



λ, ϵ = Contact parameters

f_{ij} = Creepage parameters

F_{axle} = Primary suspension forces

P_w = Axle load

F_g = Gravitational w/r forces

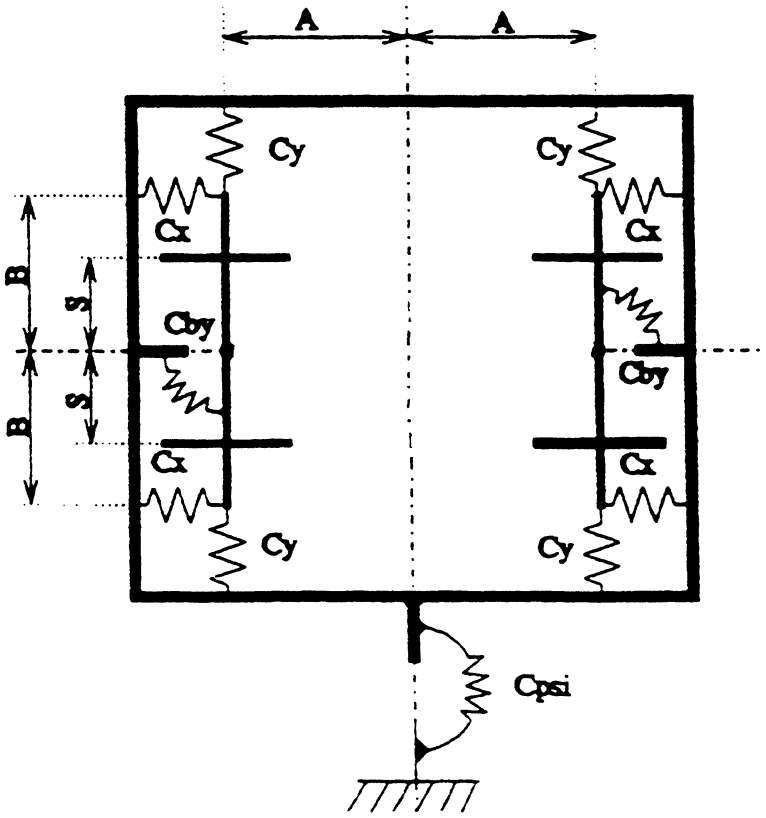
Verification -

Vehicle models & Results

- Reference model
- ADAMS/Rail model
- Comparison

Vehicle models & Results

- Reference Model

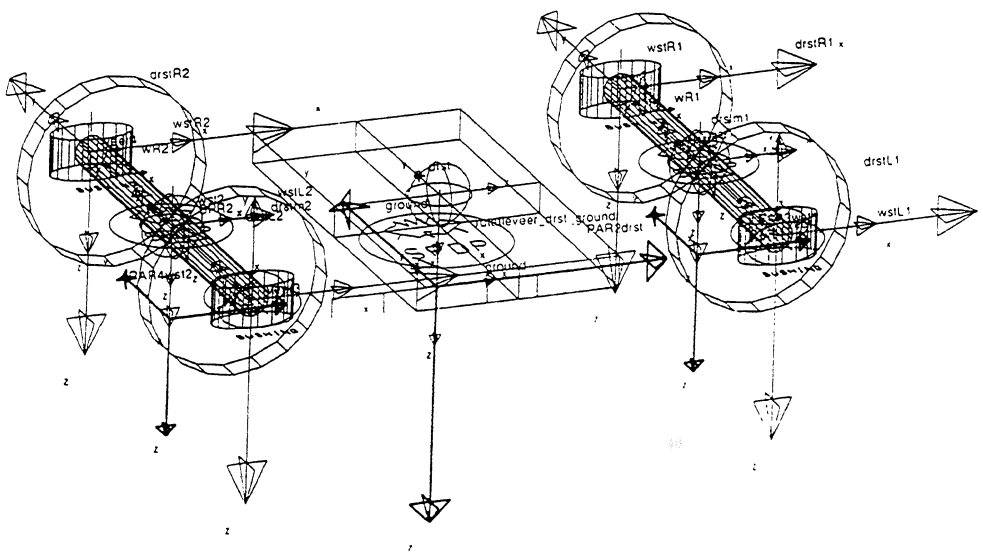


- Carbody replaced by ground

Vehicle models & Results

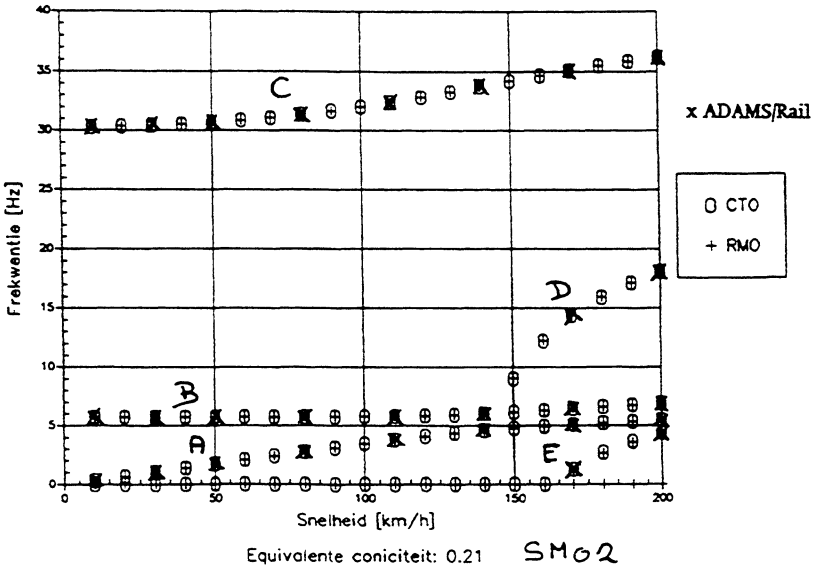
- ADAMS/Rail model

front model=vehicle_model

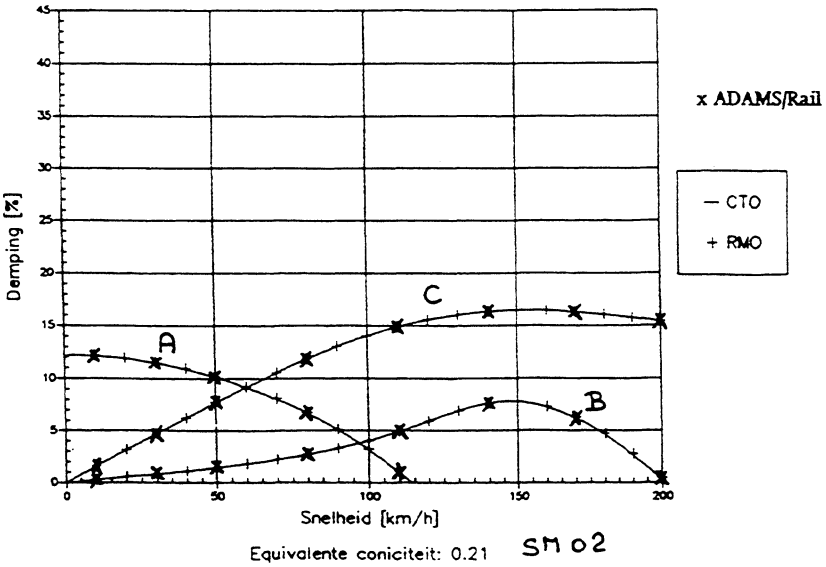


Vehicle models & Results

- Comparison



Equivalente coniciteit: 0.21 SM02



Equivalente coniciteit: 0.21 SM02

Verification -

Conclusion

Excellent agreement was found on:

* eigenfrequencies

* damping

for arbitrary combinations of speed,

conicity and spring stiffness

Id. aan: OO/MB/95/LT/77

B. Application of ADAMS/Rail in 'Vehicle Response Analysis'

- goal of VRA

'the evaluation of
measured track irregularities
on the basis of
calculated vehicle responses'

- for example

evaluation on the basis of vertical comfort calculations

* Model
* Verification
* Results
* Conclusion

Track model

- track measurements

section Eindhoven - Venlo
including:

* Top-level (vertical)
* Cross-level (cant)

irregularities

- example

Section: Ehv-Vl Km 26-23
Interval: 27.784 cm
Units: mm
Measurement date: 30-09-94 Processing date: 07-12-94

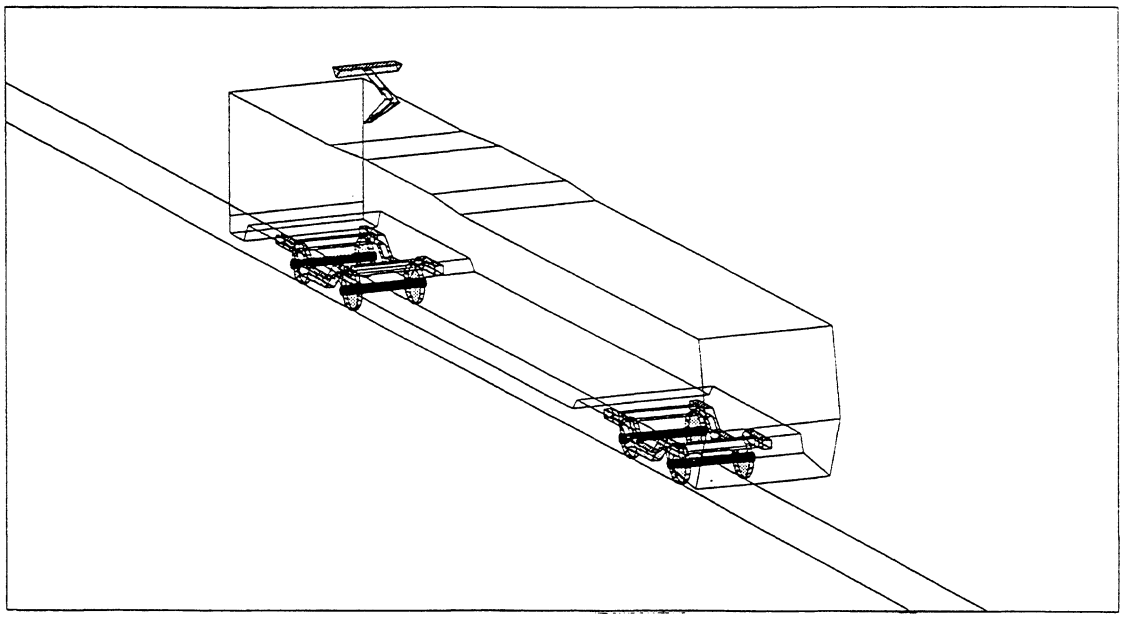
cross-level	top-level	shift
0.00	0.78	0.56
0.20	0.73	0.51
0.37	0.56	0.49
0.07	0.22	0.24
0.12	0.12	0.15
0.20	-0.07	0.02
0.17	-0.12	0.10
-0.02	0.02	0.10
0.10	-0.12	-0.02
0.34	0.12	0.05
-0.07	0.05	-0.07
-0.10	-0.05	-0.29
-0.34	-0.29	-0.54

Vehicle model

- Railhopper SM'90 stopping train

* linear 3-D model
* Nishimura airsprings

- system configuration



System verification

- based on eigenfrequencies & damping ratios

- results

Eigenmode		SM'90ABk ADAMS		SM'90ABk Measured	
		f [*Hz*]	κ [–]	*f* [*Hz*]	κ [–]
Carbody	bounce	1,23	0,15	1,22	0,15
	pitch	1,68	0,15	1,76	0,17
	roll	0,70	0,10	0,60	0,10
Motor bogie	bounce	5,85	0,30	5,95	0,32
	pitch	5,77	0,36	5,87	0,20
Trailing bogie	bounce	6,85	0,15	6,94	0,12
	pitch	8,29	0,24	8,21	0,26

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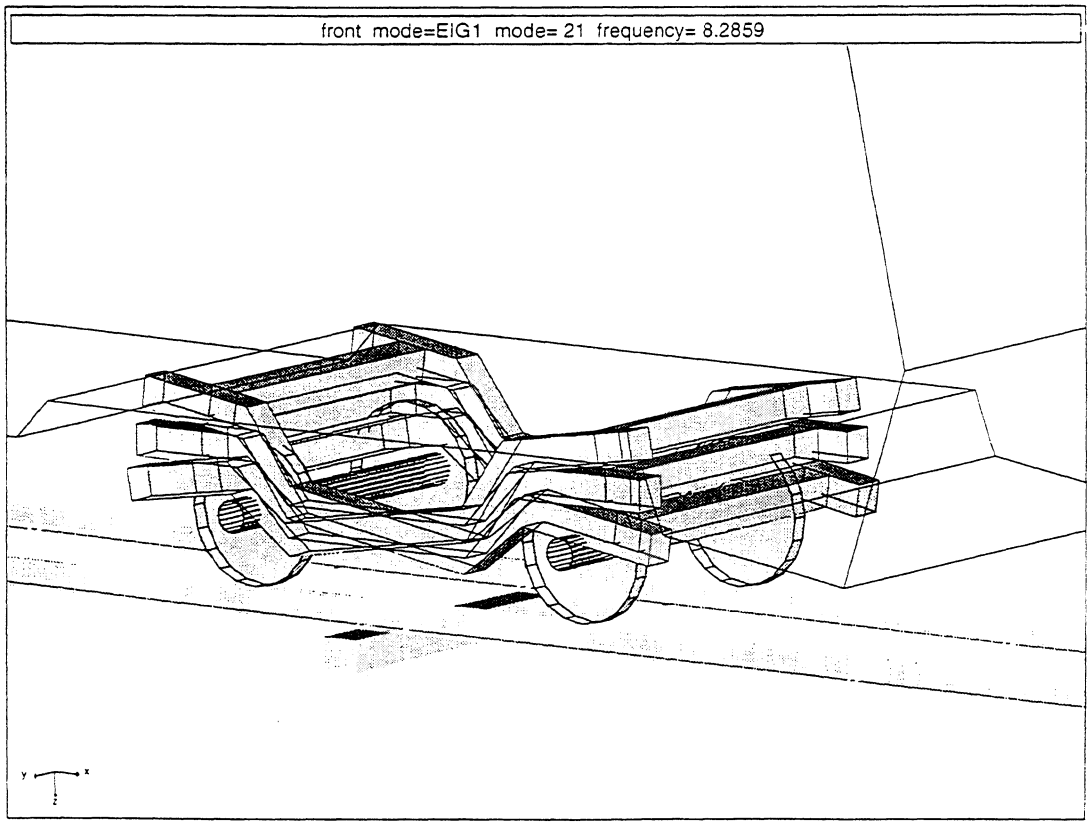
System verification

- illustrations



Results

- RMS vertical accelerations

Observation point:		SM'90ABk ADAMS	SM'90ABk measured
		RMS [m/s²]	***RMS [m/s²]***
Carbody	front	0,15	0,16
	rear	0,20	0,20

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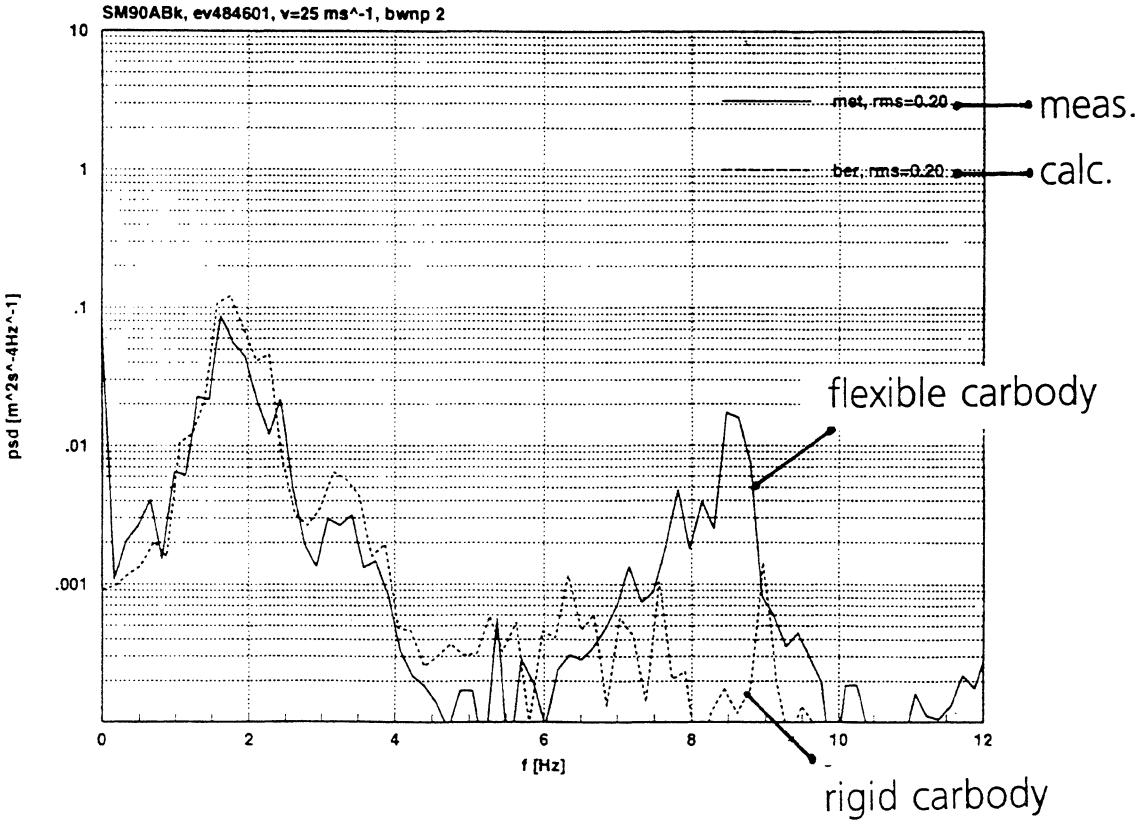
- Comfort indices

Observation point:	SM'90ABk ADAMS			SM'90ABk Measured		
	N_{mv}	W_z	RI	N_{mv}	W_z	RI
front	0,5	2,0	11,1	0,5	1,9	10,0
rear	0,6	2,1	14,4	0,7	2,0	13,1

Results

- PSD vertical acceleration

carbody rear



Conclusions

- the comfort measurements could be predicted with an accuracy of 15 %

- the deviation in the comfort calculation lies out of the passengers sensivity range

Recommendations

- increase of the wavelength range of the track to 70 m

- flexible carbody