

Improving Child-Seat Concept Design by TRIZ - Second Report - Minami Hamada

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Conventional design



- Side guards block smooth loading of a child.
- Seat straps are too tight.
- Vibration isolation is poor.

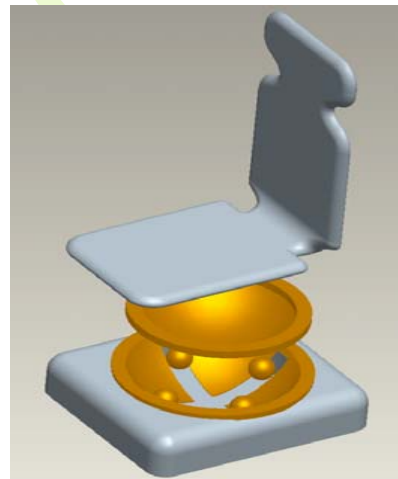
New but incomplete concept

Swing Child-Seat

Seat on a spherical swivel



- Pendulum motion to counter lateral G.



- Before After
- Pop-up side guards for easy loading.

Problems remain unsolved

Problem #1

Rolling or pitching oscillation lingers after a shock.

Problem #2

Child occupant's posture does not follow the vehicle's orientation change because of the spherical swivel.

Ideal final results

Problem #1

Suitable amount of damping

Problem #2

Child occupant can always look forward

Substance-field analysis

Poor ride quality

Child occupant

Protection in collision

Child seat

Seat pad & back

Fix

Spherical guide upper

Allow pendulum motion

Let oscillation linger

Rolling balls

Allow rolling

Transmits vibration

Spherical guide lower

Fix

Transmits vibration

Base

Fix

Transmits vibration

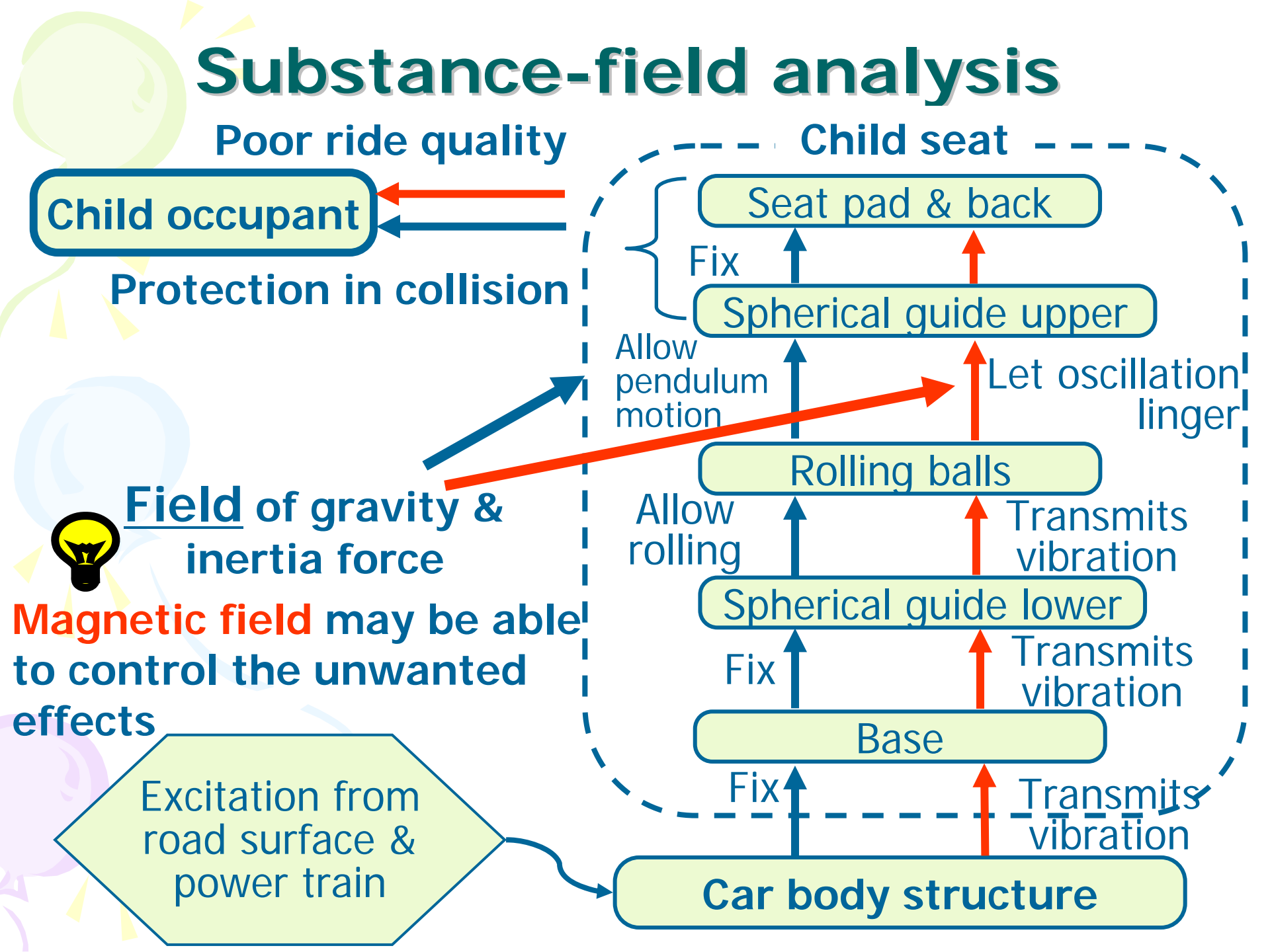
Car body structure

Field of gravity & inertia force



Magnetic field may be able to control the unwanted effects

Excitation from road surface & power train



Inventive principle: **Increase dimension**

Ideal final results:

Free pitch & roll motion

No yaw motion

Sphere

$$R(\varphi, \psi, \theta) = \text{constant}$$

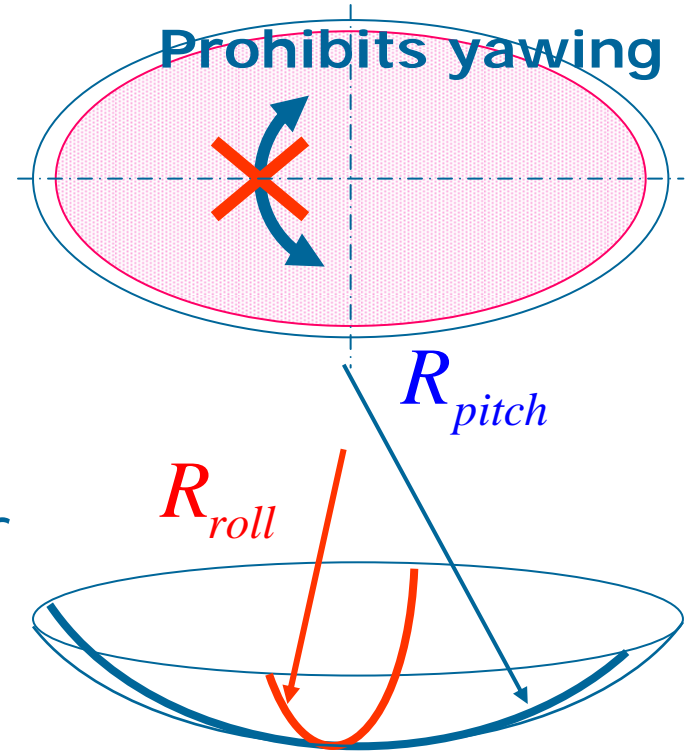
Circular orbit
in horizontal
plane



Improved

$$R_{pitch} \neq R_{roll}$$

Non-circular
orbit



Summary

Function
analysis

F-S analysis
Inventive
principle



Improved
conceptual design