

# Review of: "Simulation of Control System for a Half-Car Suspension System for Passenger Vehicle Application by Designing an LQR Controller"

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Potential competing interests: No potential competing interests to declare.

## General summary and impression

The increasing development of new vehicle and chassis systems has a major impact on drivability, handling and ride comfort. A sufficient control of active-chassis actuators helps maintaining an optimal vehicle performance and driving experience. The present paper presents a method of active suspension control using a Linear Quadratic Regulator (LQR) control approach.

The scope of the article is very interesting and the method reflects state of the art methods. Moreover, the mathematical description of the model is well explained and illustrated. The authors conclude relevant points of the study and the statements can be mostly found in the plotted data. A more precise description of further research potential and intensions would be great to be added.

Nevertheless, the article should be improved generally. (see below). At the moment, the following ratings are given by reviewer:

- Novellity / Actuality: 4/5
- Description of Work: 3/5
- Format / Appearance: 2/5
- Scientific Work: 3/5
- Total: 3/5

## Comments on the content

- p. 1: Compared to the antiquated passive suspension technology, its performance is superior (PSS) → since PSS is later defined as passive suspension system, the abbreviation should not be used here in another context (→ *Abstract*)
- p. 2: The comparison between the three suspension system types is very flat and should be improved, e. g. benefits and disadvantages of all systems not only passive ones / technical and financial efforts / energy balance / system dynamics / ...
- [...], researchers have suggested LQR control methods. / Only a few researchers have focused on [...] / [...] there have recently been a few studies [...] → Reference(s)?

- using a static dynamics model → more details necessary → Which boundaries are given?
- p. 5: information of dimensions can be derived from Fig. 1 (additional graphic not necessary)
- p. 6: In this study, PID and LQR controllers are used [...] → PID controller not mentioned before or later → What for?
- p. 7: efficacy → *efficiency* (typo)
- p. 9: [...] with minimal pitch in the lateral direction [...] → pitching dynamics around y-axis, but not in lateral direction
- p. 10: LQR controller improves ride quality by reducing overshoot and achieving a small steady-state error → information can be derived from the plots, but is there any numerical evaluation (e.g. RMSE)?
- Fig. 10 - Fig.13: Why are 20 km/h and 60 km/h shown for road type B and 40 km/h and 80 km/h for type C? → better: comparison of all via plots beside each other or numerical KPI (max. body velocity, peak-to-peak, RMSE, ...) in a table

### Comments on the format / appearance

- p. 4: Poor readability of Fig. 1
- p. 7: "K" should be written in the article in vector notation, not in the format of Matlab's Command Window output
- different legend and axes title position between the subplots (Fig. 4) + Label of Fig. 4 on next page
- road input = ... → formula editor Word(?) → different font than rest of the text
- Fig. 5: different order of colors + very small size (larger graphic would improve readability)
- Fig. 6: Instead of four different colors, two colors and two line styles would increase readability of the plot; alternatively two subplots for front and rear wheel would be beneficial
- Fig. 6 / Fig. 7: legend entries inconsistent by using hyphen
- nearly all plots have different size, font size and resolution → appearance very low!
- Font changed to Calibri for one section after Fig. 4, Fig. 5, Fig. 7, and Fig. 9
- p. 9 / p. 10: sections under Fig. 8 and above Fig. 10 in Calibri Font
- inconsistent use of km/h and km/hr
- Fig. 10 - Fig. 13:
  - different colors of the data decreases readability → dedicated subplots for both wheels or color and line style combination from Fig. 6
  - identical scaling of y-axis would make difference much clearer at the first look