# Problem 1

A. Calculate the force, 𝐹𝑦, under this lateral slip assuming a sinusoidal pressure distribution as shown below. Comment on the potential position of 𝑥𝑠 and is there a discontinuity?

Chart

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* **Derivation of 𝐹𝑦 for sinusoidal distribution is attached at end of this document.**
* **For given data, 𝐹𝑦 = 3332.9 N**
* **For given lateral slip, 𝑥𝑠 = 0.0666 m. Assuming a sinusoidal pressure distribution, the position of transition point from front end of the tire patch i.e. 𝑥𝑠 can lie between 𝑥=0 and 𝑥=10 cm, depending upon the slip angle of tire. There is no discontinuity and there is no gap between the sticking and sliding regions.**

B. Compare this resulting lateral force with the one resulting from the parabolic model. Plot the lateral force 𝐹𝑦, over a range of slip angles, for both pressure distributions.

* **For parabolic model, 𝐹𝑦 = 3379.0 N (for given data)**
* **Fy vs SA plot for both distributions, various slip angles:**

Chart, line chart

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C. Comment about the transition point for the following bilinear distribution (Fig 2) and how it affects sliding region.

* **The position of transition point from front end of the tire patch i.e. 𝑥𝑠 can lie between 𝑥>a and 𝑥<=2a since for a line with (slip) angle greater than or equal to the angle of the first line of the bilinear distribution, the entire tire patch will be sliding.**

# Problem 2

1. Plot nondimensional lateral force vs. nondimensional slip angle.

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2. Add a plot of the Magic Formula over the data in question #1

Chart, scatter chart

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3. How do these coefficients compare with the one derived from the plot in question #1 and from the relationships given in class?

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|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Pacejka Coefficient** | **B** | **C** | **D** | **E** |
| **Given Value** | 0.6000 | 1.6667 | 1.0000 | 0.2000 |
| **Derived Value** | 0.6560 | 1.3071 | 0.9535 | -0.7593 |

4. Expand the nondimensional model at the five measured normal loads. Create a plot of lateral force vs. slip angle, showing both the measured data and the model predictions.

Chart, scatter chart

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5. Also expand the Nondimensional Model at –200, –300 and –400 lb normal load. Plot the result on the same figure as question #4

Chart, scatter chart

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