

Set 6 - Modelling traffic flow with a Bimodal function

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The study aims to understand vehicular traffic flows to reduce congestion and develop effective traffic control methods. The model uses data from the Alabama Department of Transportation's repository for Jackson, Alabama, focusing on the one-dimensional traffic at a given hour. The data is based on average values of Wednesday traffic data from 2007 to 2007.

I. BIMODALITY IN TRAFFIC FLOWS

A. Model

- Jackson City allows for two-way traffic flow. At Mid-day 12 : 00, the time is scaled to $t = 0$. The formula used to simulate traffic flow is shown below, it is the bimodal function and it has three turning points, a local minimum, and two peaks. Its fundamental property is controlled by the parameter μ . For $t \rightarrow \pm\infty$, there is an asymptotic decay of N .

$$N(t) = A (\mu + t^2) \exp \left[-(\lambda t - \beta)^2 \right] \quad (1)$$

B. Results

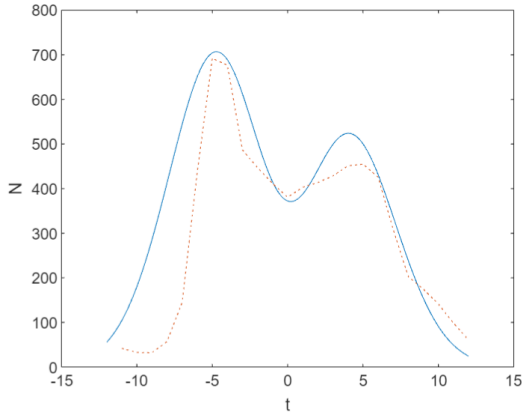


FIG. 1: Bimodal distribution of traffic flow due west, plotting traffic volume, N , at time, t (hours). The time is scaled to set $t = 0$ at midday, 12:00 hours. The dotted broken curve joins the real data points, and the continuous curve traces the model given by Eq. (1), with $A = 44.0$, $\mu = 8.53$, $\lambda = 0.19$ and $\beta = 0.09$

- For Fig-1, the mean and standard deviation of relative variation are $\mu_r = -0.085$, $\sigma_r = 0.528$

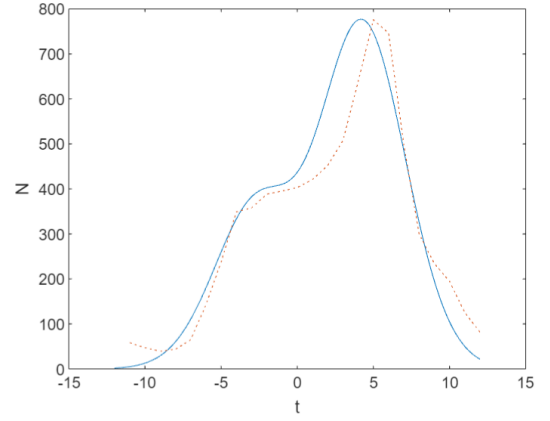


FIG. 2: Bimodal distribution of traffic flow due east. The plotting follows the method used for the westward traffic, with $A = 44.1$, $\mu = 10.5$, $\lambda = 0.22$ and $\beta = 0.24$. The sign and the absolute magnitude of λ make the most significant difference between the two bimodal distributions

- For Fig-2, the mean and standard deviation of relative variation are $\mu_r = 0.723$, $\sigma_r = 2.276$

C. Conclusions

- The workplaces must be in the western section of the city since traffic to the west is heavy during the day and heavy during the evening.
- The majority of the households must be in the city's eastern section for the same reason.

[1] Arjun Mullick, Arnab K. Ray, Nonlinear dynamics of bimodality in vehicular traffic(2016).