Chapter 6

Nonlinear dynamics

"Of all the possible paths along which a dynamical system may move from one point to another within a specified time interval (consistent with any constraints), the actual path followed is that which minimizes the time integral of the difference between the kinetic and potential energies."
– Sir W.R. Hamilton, *On a General Method in Dynamics (1834)*

6.1   Two-Dimensional Flows

6.1.1   *The problem of R+J*

Let us define two functions $\{R(t), J(t)\}$ that represents the 'feelings' of a given gender-neutral person named R and another given gender-neutral person named J. Traditionally, R and J are depicted to be of different genders but in the context of writing in 2020, one cannot make bold assumptions of gender identification nor sex orientation. Thus the definition of these functions shall remain as gender-inclusive as possible. It is a relief that the mathematics remain equivalent and do not discriminate against different genders nor orientation. The changes in R and J's feelings are dependent on their own feelings and each other's feelings, such that:

$$\dot{R}(t) = \rho_1 R + \rho_2 J$$
$$\dot{J}(t) = \iota_1 J + \iota_2 R$$

(6.1)

where $\dot{R}(t) = \frac{\partial R(t)}{\partial t}$ is the change in feelings of R and it is dependent on R's current feeling and J's current feeling, with respective coefficients ρ_1 and ρ_2. The same goes for $\dot{J}(t)$.

6.1.1.1   *Classification of romantics*

Consider the 9 different possible sets of values that ρ_1, ρ_2 can take. We can classify the different styles of romance that the different sets of coefficients would produce. Here, ρ_1, ρ_2 corresponds to equation 6.1 and let's say that R is a dude and J is a chick.

- $\rho_1 = 0, \rho_2 = 0$: ice man
  An ice man's feelings remain forever constant and is incapable of changing after the initial feelings are set. No fucks given whatsoever.
- $\rho_1 = 0, \rho_2 > 0$: agreeable conformer
  An agreeable conformer will not pay attention to his own feelings, but will conform to whatever the girl feels. If the girl likes him, then he will like the girl back; vice versa.
- $\rho_1 = 0, \rho_2 < 0$: troll
  A troll will start hating the girl if the girl likes him. And he will love the girl if the girl hates him. A troll is just there to fuck shit up.
- $\rho_1 > 0, \rho_2 = 0$: egomeister
  An egomeister only changes his feelings according to how he feels himself and has no care for how the girl feels.
- $\rho_1 > 0, \rho_2 > 0$: desperate rabbit
  A desperate rabbit will turned on if the girl likes him. He will also be turned on more by his own desire for the girl. He can also get very depressed though.
- $\rho_1 > 0, \rho_2 < 0$: cold-ass seeker
  A cold-ass seeker is a rather odd ball, he will like the girl more if he already likes the girl but he will get even more turned on if the girl hate his guts.
- $\rho_1 < 0, \rho_2 = 0$: absurd egomeister
  Strange cousin of the egomeister - he tends to start liking the girl if he didn't already like her. Of course, he has no care for the girl's feelings.
- $\rho_1 < 0, \rho_2 > 0$: self-doubting lover
  A self-doubting lover will suppress his own feelings and react positively to the girl's feelings.
- $\rho_1 < 0, \rho_2 < 0$: suicide boi
  Not a healthy mix of personalities - a suicide boy will absolutely hate the girl if he likes the girl and the girl likes him. Don't ask me, makes no sense.

This classification works the same for J if you just swap in ι_1, ι_2. Since we have described 9 different kinds of lovers, there are 45 unique kinds of couples.

$$\sum_{i=1}^{N=9} i = \frac{N(N+1)}{2} = 45$$

Instead of going through all of these cases one by one, we can write a generic solver.

6.1.1.2   *Under the influence of friends*

External environmental perturbations can be considered to enhance the realism of the dynamics. To be discussed...

$$\dot{R}(t) = \rho_1 R + \rho_2 J + \nu_R$$
$$\dot{J}(t) = \iota_1 R + \iota_2 J + \nu_J$$

(6.2)