CONTINUUM'22

Problem Statement-1

Konoha is a popular village located in the Fire Country. In the village Konoha, the main aim for any young kid is to become a " ninja" of good caliber. Naruto and Sasuke are two such kids who want to become as strong as possible. So they both have been training to become strong for reaching their goals. Naruto and Sasuke come up with a combined technique using both their abilities to create a new technique. This technique uses Naruto' ability to multiply himself and Sasuke's ability to multiply a shuriken and combine both of them.So for the combination to work, both the number of Narutos and the number of shurikens must match. Naruto's ability is similar to binary fission - he can clone himself into two every second, that is, initially he can clone himself into 2 after 1 sec, then after 2 seconds there will be 4 clones and so on. Sasuke's ability is to multiply the number of shurikens 8 times, that is, initially he has 1 shuriken, then after 1 sec he has 8 shurikens and so on.

Naruto is already at the training ground waiting for Sasuke to start their technique. Naruto hates waiting, so he started his technique before sasuke. Sasuke arrives at the training ground 4 seconds late and has started his technique immediately after arriving there.

The rate of growth for both the techniques is proportional to the number of clones present at the moment.

So, let the number of clones at any time be C(t).
The rate of growth of clones is dC/dt.

Hence, it gives us the equation:

$$\frac{dC}{dt} = k.C(t), \quad \text{where } k \neq 0.$$

Your task is to build a circuit to calculate the growth of Naruto's clones and Sasuke's shurikens and find out if they can combine their techniques at any point of time in the above situation.

Growth calculator:

Given that initially there was only 1 Naruto and he multiplies by binary fission and initially Sasuke has 1 shuriken and he multiplies it by 8 times, and he starts 4 seconds after Naruto has started.
Find the plots of the number of clones versus time and number of shurikens versus time using analog circuits. Also check whether these two plots intersect at any time.

Software to be used:

- OrCad

Judging criteria:

Difference in desired output and received output (efficiency).
Cost of the circuit made:

- Operational amplifier -> 400/-
- Inductor -> 80/-
- Capacitor -> 80/-
- Resistor -> 10/-
- Diode -> 80/-
- Transistor -> 160/-

Submission Guidelines:

➔ Submit your solution in the D2C portal before April 2nd, 11.59 pm.

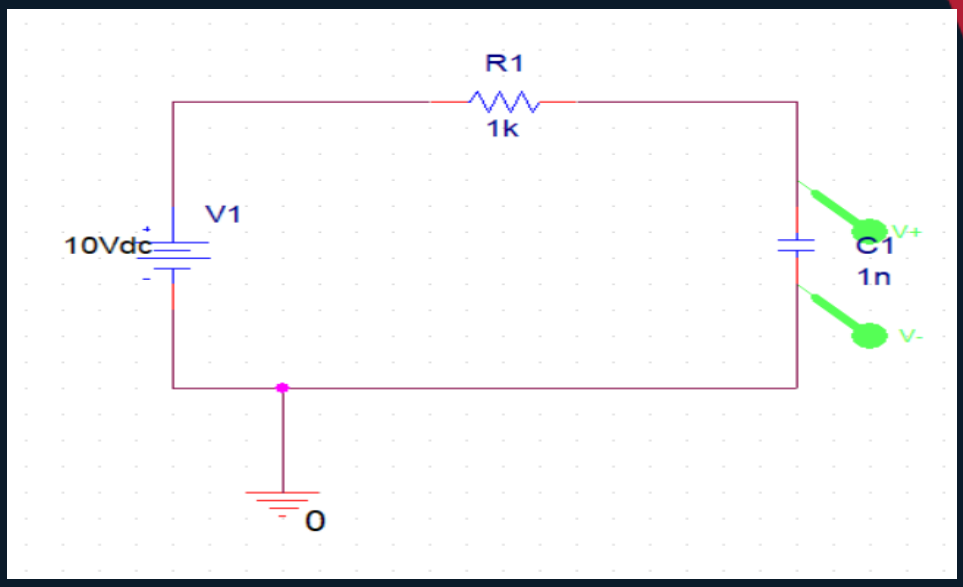
➔Create a "new project" in OrCad and submit the whole project as a zip file. (Do not send just the schematics, send the whole project).

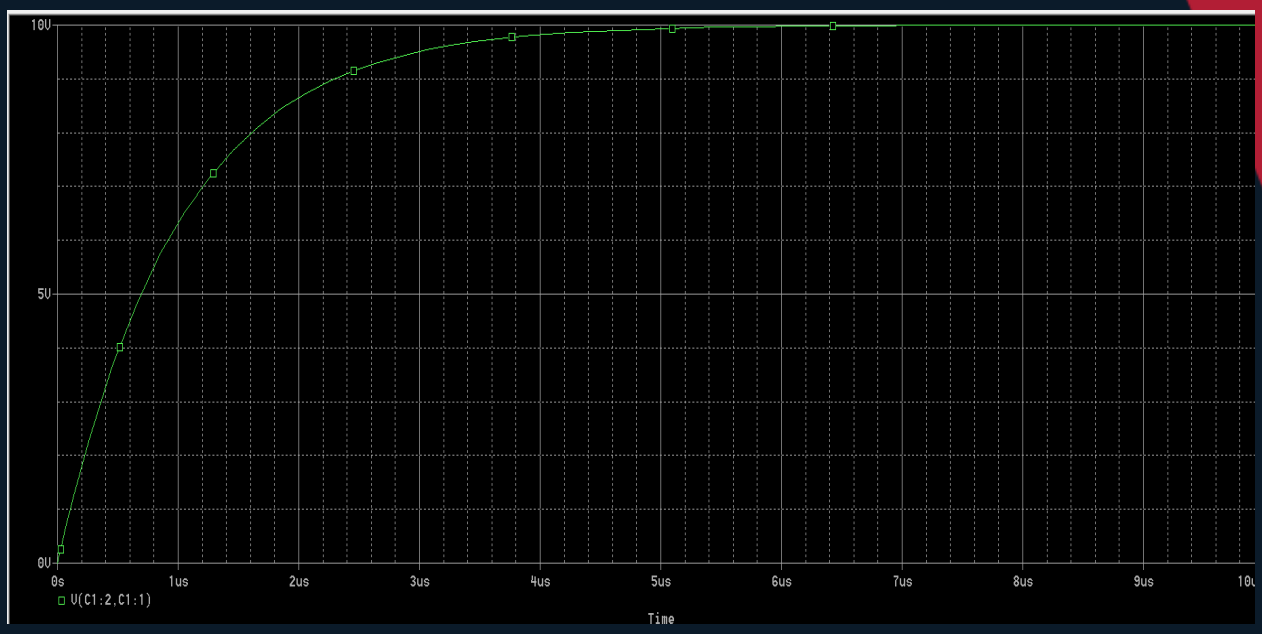
➔Also add the screenshots of the circuit diagrams and the plots of clones vs time and shurikens vs time in the zip folder.

If anyone faces any issues in submitting the solution, they can mail the solution to us:

- nvikranth.choudary.ece19@itbhu.ac.in
- bveera.vpkalyan.ece19@itbhu.ac.in
  (subject of the mail: Continuum PS-1<team_name>)

Example screenshots to be attached:





You can add the plots of **two different simulations** in the same schematic by using the **"append file"** option present in the schematic.

UDYAM'22

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