HEFTI
High-Energy Frequency Tesla Inc.

8 Stage PFN Marx Generator

Specifications

- 8-stage Marx generator
- Ten capacitors per stage for the total of 80
- Capacitance per stage is 26 nF
- Charging voltage per stage varies from 12 to 40 kV
- Maximum stored energy in the system is 160 J
- Impedance of the load is 50 Ω
- Coaxial structure employed
- Excellent reproducibility of the output pulse

Applications

- Study of electron/ion emissions for beam processing systems
- Energize small high-power microwave systems
- Prototype design in multi-target instrumentation radar modulators

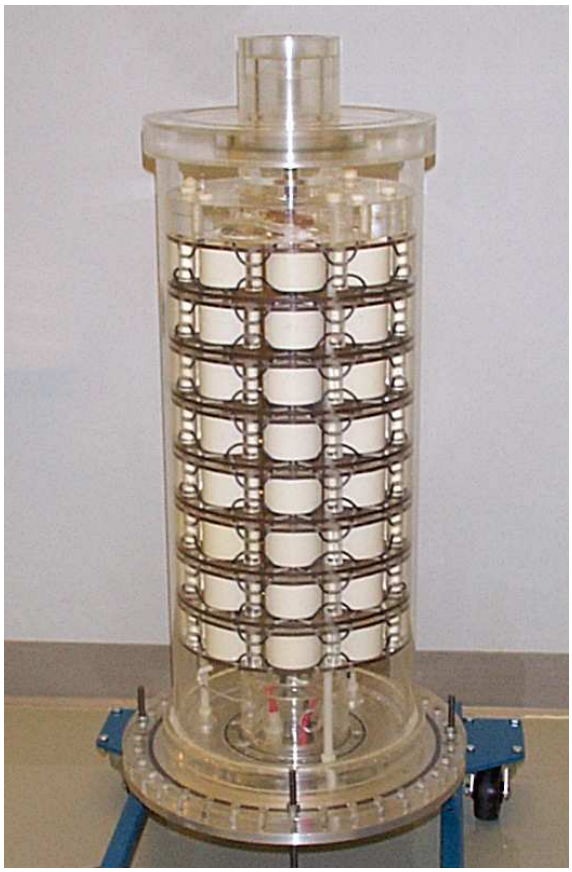

Figure 1 Photograph of 8-stage PFN Marx generator. Base measures 12 inches (30 cm)

Design Considerations

The PFN Marx can have N stages and each stage contains n capacitors. The energy stored in the system is $nNCV^2/2$. V is the charging voltage of the stage. If the inductor, L is placed between two adjacent capacitors, C, the transmission line is formed in each stage.

As shown by M.M. Kekez[1], the PFN Marx can be presented as an open-ended length of the transmission line charged at potential NV. The internal impedance of the PFN Marx is NZ. $Z=(L/C)^{1/2}$ is the characteristic impedance of the stage. The square shaped pulse can be obtained, if the load, R is close to NZ. The duration of the pulse, T is $2n(LC)^{1/2}$. Figure 3 shows that the pulse can be stretched by increasing both L and R.

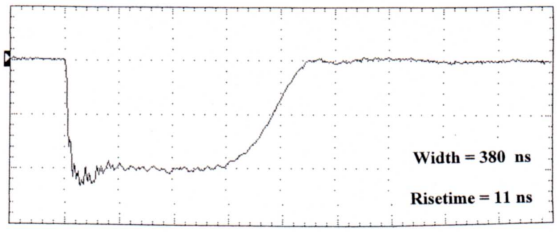

Figure 2. Output pulse (50 kV/div; 100 ns/div) for 50 Ω load. With the capacitive probe the rise time falls to 4-5 ns.

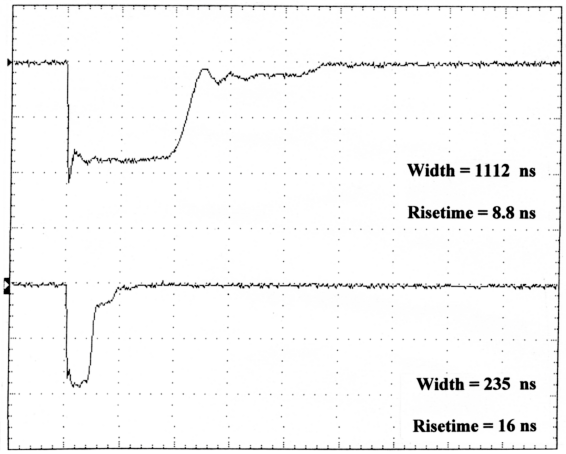

Figure 3 Output pulse (10 kV/div; 1000 ns/div) of two-stage PFN Marx generator with 10 capacitors of 1.7 nF in the stage. Between two capacitors the inductor, L was placed. At the top L = 2.1 μH with R = 79 Ω. At the bottom L= 92 nH with R = 17 Ω. The ratio between the width of two pulses is 1112 ns/235 ns = 4.73. The ratio between the loads is 79Ω/17Ω = 4.65

[1] M.M. Kekez. Proc. of 11th IEEE Pulsed Power Conference, Baltimore, USA, June 29-July 2, 1997, pp 1524.

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