

Tee magic tee Coupler

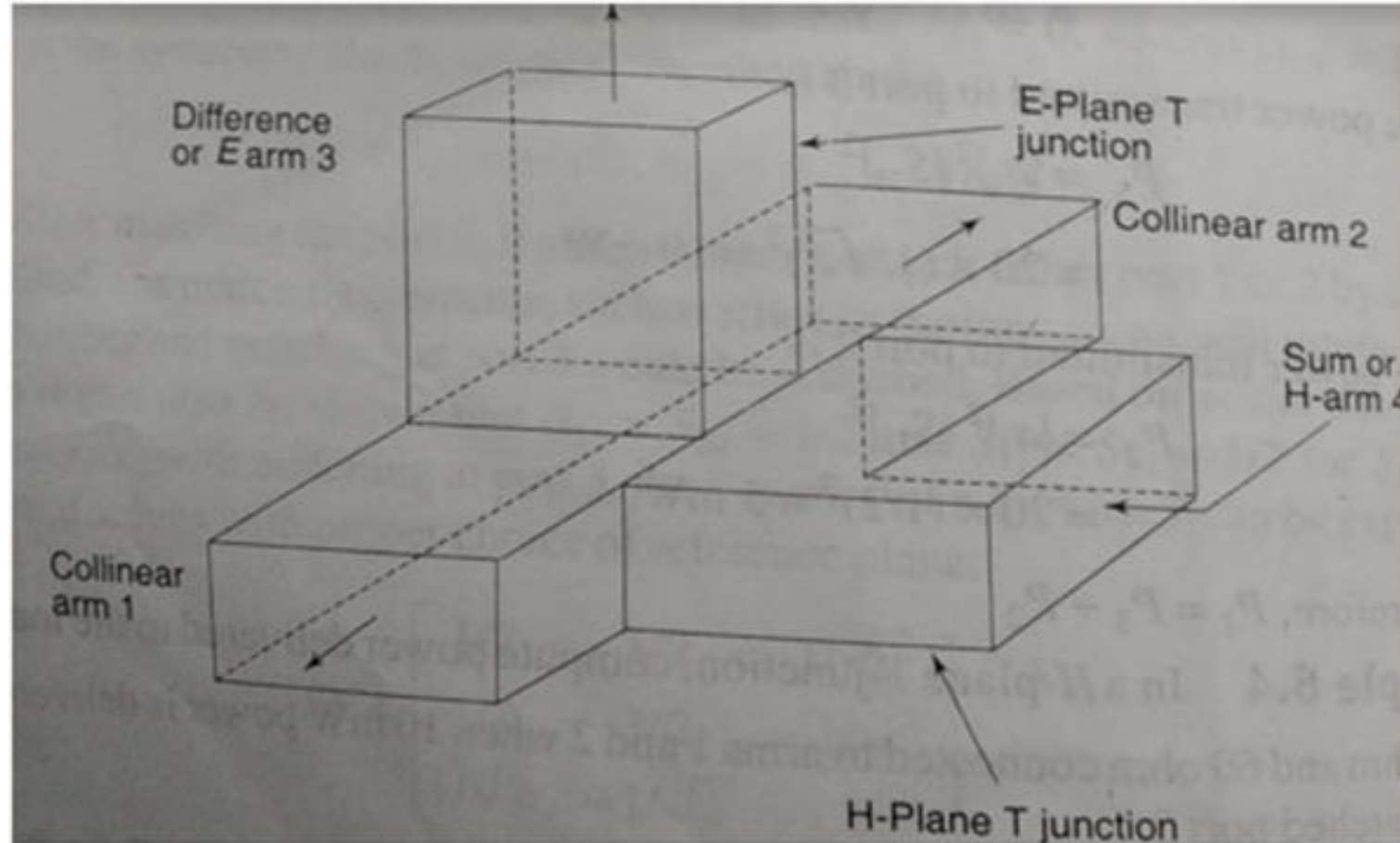
Name: Sparsh Arya

Registration Number:17BEC0656

Slot: F1

Subject: Microwave Engineering

MAGIC TEE DESIGN



S MATRIX

$$[S] = \begin{bmatrix} S_{11} & S_{12} & S_{13} & S_{14} \\ S_{12} & S_{22} & -S_{13} & S_{14} \\ S_{13} & -S_{13} & 0 & 0 \\ S_{14} & S_{14} & 0 & 0 \end{bmatrix}$$

From the unitary property applied to rows 1 and 2, we get

$$|S_{11}|^2 + |S_{12}|^2 + |S_{13}|^2 + |S_{14}|^2 = 1$$

$$|S_{12}|^2 + |S_{22}|^2 + |S_{13}|^2 + |S_{14}|^2 = 1$$

Subtracting these two equations:

$$|S_{11}|^2 - |S_{22}|^2 = 0$$

or,

$$|S_{11}| = |S_{22}|$$

From the unitary property applied to rows 3 and 4

$$2 |S_{13}|^2 = 1, \text{ or } |S_{13}| = 1/\sqrt{2}$$

$$2 |S_{14}|^2 = 1, \text{ or } |S_{14}| = 1/\sqrt{2}$$

Substituting these values in (1)

$$|S_{11}|^2 + |S_{12}|^2 + 1/2 + 1/2 = 1$$

or,

$$|S_{11}|^2 + |S_{12}|^2 = 0$$

which is valid if $S_{11} = S_{12} = 0$ — (3)

From Eqs (2) & (3)

$$S_{22} = 0$$

Therefore,

$$[S] = \begin{bmatrix} 0 & 0 & S_{13} & S_{13} \\ 0 & 0 & -S_{13} & S_{13} \\ S_{13} & -S_{13} & 0 & 0 \\ S_{13} & S_{13} & 0 & 0 \end{bmatrix}$$

where

$$|S_{13}| = 1/\sqrt{2} = |S_{14}|$$

References

- Microwave Engineering- David M. Pozar
- https://www.tutorialspoint.com/microwave_engineering/microwave_engineering_introduction.htm
- <https://www.microwaves101.com/encyclopedias/waveguide-mathematics>
- [https://en.wikipedia.org › wiki › Microwave_engineering](https://en.wikipedia.org/wiki/Microwave_engineering)