Subject 1

Mismatch design methodology
Network variables

- Voltage – between two nodes
- Current – at a loop

There are two ways to describe a source driving an input of a circuit:

1. Voltage source with a series impedance driving an input port
2. Current source with a parallel impedance driving an input port
Circuit description for the two options

Voltage source description

Current source description
Impedance mismatch between $Z_{in}(s)$ and $Z_s(s)$ exist when one of the following relation is valid:

A. $|Z_{in}(s)| >> |Z_s(s)|$

B. $|Z_{in}(s)| << |Z_s(s)|$

When A exist – Voltage source description is preferred
When B exists – Current source description is preferred
Description of circuit output

- Circuit output description is similar to that of an input.
Impedance mismatch between $Z_o(s)$ and $Z_L(s)$ exist when one of the following relation is valid:

A. $|Z_L(s)| >> |Z_O(s)|$

B. $|Z_L(s)| << |Z_O(s)|$

When A exist – Voltage source description is preferred
When B exists – Current source description is preferred
Impedance mismatch design methodology

Impedance mismatch design methodology is a methodology of design where impedance mismatch exists at the input and the output of a circuit. For each case the “main” network variable is defined by the description of the input and output circuit.
Input description

- When voltage description at the input is the preferred description the “main” network variable at the input is voltage.

- When current description at the input is the preferred description the “main” network variable at the output is current.
Output description

- When voltage description at the output is the preferred description the “main” network variable at the output is voltage.

- When current description at the output is the preferred description the “main” network variable at the output is current.
Dependent and independent variables

- The independent variable at the input matches the main network variable. This variable is called input stimulus.
- The complementary variable at the input is called input response.
- The dependent variable at the output matches the main network variable. This variable is called output response.
Transfer function

Transfer function is defined as:

\[
\frac{\text{Response at the output}}{\text{Stimulus at the input}} = \frac{\text{Stimulus at the output}}{\text{Stimulus at the input}} = 0
\]

When impedance mismatch exists at both input and output the transfer function is not a function of \(Z_s, Z_in, Z_o, Z_l\).
A stimulus to a “low” impedance port is current. The response is voltage.

A stimulus to a “high” impedance port is voltage. The response is current.

Impedance mismatch simplifies the expression for the Transfer function from source to load.