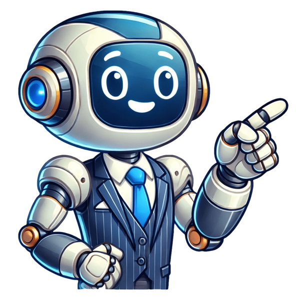

Mesh Current Analysis Method is used to analyze and solve electrical networks with various sources or circuits comprising multiple meshes or loops with voltage or current sources. This method is also known as Loop Current Method. In Mesh Current, a distinct current is assumed in each loop, and the polarities of drops in each element are determined by the assumed direction of the loop current for that loop. The unknowns in mesh current analysis are the currents in different meshes, which can be solved using Kirchhoff's Voltage Law (KVL). KVL states that the net voltage applied to a closed circuit is equal to the sum of the product of current and resistance or the sum of voltage rise equals the sum of voltage drop. The method involves identifying independent circuit meshes, assigning circulating currents to each mesh in a consistent direction, writing KVL equations for each mesh, and solving these equations simultaneously to obtain the values of the mesh currents. To find mesh currents, follow these steps: first, get the equations for mesh currents. Next, use Ohm's Law to determine element currents and voltages. Note the exception that if your circuit is non-planar or you have a shared current source, apply the Loop Current Method instead of the Mesh Current Method. The Loop Current Method is just a variation of the Mesh Current Method. Let's define some essential terms: loops and meshes. A loop is any closed path within a circuit. To identify a loop, start at any component terminal and follow the connected elements until you return to where you began. There's only one rule: a loop can pass through an element just once. In our given circuit, there are three loops: two solid loops, I and II, and one dashed loop, III. A mesh is a type of loop that doesn't contain any other loops. Loops I and II in the given circuit are meshes since they don't have smaller loops inside them. The dashed loop isn't a mesh because it has multiple loops within it. In the Mesh Current Method, we use meshes to create KVL equations, which always gives us the right number of independent equations. In circuit analysis, the term "mesh" refers to two different concepts: the material making up a network of wire or thread and the space between individual strands in a network. Similarly, mesh current is an imagined current flowing through each mesh. When using the Mesh Current Method, we consider mesh currents as if they were real currents flowing around meshes. In our example circuit, let's define mesh currents I and II flowing around loops I and II, respectively, with positive directions indicated by arrows. It's clear that I is the current in source V1 and resistor R1, while II is the current in resistor R2 and source V2. However, it's not immediately apparent what's happening with the current in R3. To better understand this, let's take a closer look at R3. The element current flowing through R3 seems to be influenced by both mesh currents I and II. But how do these mesh currents relate to the actual element current in R3? This is where we need to apply the Mesh Current Method carefully to ensure accuracy in our calculations. Here's a rewritten version of your text: The concept of superposition allows us to add up two mesh currents, iI and ii, to get the actual current in the resistor, iR3. It's like adding apples and oranges – they just combine! The principle of superposition is based on linearity, which means that if we multiply the voltage by a certain value, the current is also multiplied by that same value. This property of ideal resistors lets us use superposition to solve circuits. Let's say we have two mesh currents flowing in a single circuit element. By using superposition, we can find the element current by adding up these two mesh currents. For problem 1, we need to find the element current iRx. It's like solving a puzzle – we add up the two mesh currents, one that's flowing down and one that's flowing up, and get an answer of +1 mA. For problem 2, we do the same thing but with different values, and get an answer of -4 mA. The Mesh Current Method is a helpful way to solve circuits. It involves identifying the meshes, drawing mesh current arrows, solving easy mesh currents, writing Kirchhoff's Voltage Law around each mesh, and finally finding the element currents and voltages using superposition and Ohm's Law. Let's go through the steps of this method with our circuit. We have two meshes, so we'll identify two mesh currents, iI and ii. These will help us solve for the actual current in the resistor. Looking forward to seeing everyone at the meeting tomorrow and discussing our strategies. Our main goal is to find out where we are going with this project. We need to figure out which direction everything is moving. To do that, we have to make sure both directions are going in the same way. So we have to add a current to every mesh so we can solve it. Our circuit has no extra currents, so we don't know where to start yet. But look at this example and you'll see there is a current source. If we try to figure out the mesh currents using this method, we will find that one of them flows through the current source on the left. This makes it an easy one. First we mark up our schematic with some arrows so we know what's going on. Then we add voltages next and make sure they are pointing in the right direction. After that we write down an equation for each mesh using Kirchhoff’s Voltage Law. Each voltage term is added together, but it has to equal zero. We have to take into account all of our voltages as resistance x current, or just use Ohm’s Law if there are two currents. For the first mesh, we start from the bottom left and go clockwise. The first element we come across is a 5 V voltage source. That means we get a +5 V, so that's added in. Then we move to the 2 kΩ resistor. There is a -2000 iI there, so that gets subtracted out. The next element is another 1 kΩ resistor. This one has two currents going through it and we have to take their difference into account. The author is analyzing a circuit using mesh analysis. They start by considering mesh I, which involves a resistor, a voltage source, and another current. The direction of the green element current determines the sign of the voltage term. This leads to an equation for mesh I: +5V - 2000i_I - 1000(i_I - i_II) = 0. Next, they consider mesh II, which involves a resistor, another resistor, and a voltage source. They follow the same steps as before, applying the voltage signs based on the direction of current flow. This leads to an equation for mesh II: +1000(i_I - i_II) - 2000i_II - 2V = 0. The author then writes down both equations and simplifies them by combining like terms. This results in a system of two equations: -3000i_I + 1000i_II = -5 +1000i_I - 3000i_II = +2 Their plan is to eliminate i_I by multiplying the second equation by some factor and adding it to the first equation, effectively eliminating i_I. The author explains how to analyze a circuit using the Mesh Current Method. They start by writing two equations representing the currents in two different meshes: Mesh I and Mesh II. The second equation is created by multiplying the first equation by 3 and adding it to the original equation. Next, they add the two equations together to eliminate the current in Mesh I and find the current in Mesh II. After solving for this current, they plug it back into one of the original equations to solve for the current in Mesh I. The author then explains how to use the mesh currents to find the element currents and voltages. They show that if an element has only one mesh current, its element current is equal to the mesh current. However, if an element has two or more mesh currents, they must be added using superposition. Finally, the author discusses when to choose between the Mesh Current Method and the Node Voltage Method. They recommend choosing the method with fewer simultaneous equations, which is typically the case for Mesh Current Method. The Loop Current Method differs from the Mesh Current Method in that it allows for the inclusion of loops in addition to mesh analysis. We will explore this method further in our article on non-planar and loop-based analysis. The Mesh Current Method involves: - Identifying meshes (open windows in a circuit) - Assigning current variables with consistent direction - Solving easy meshes connected to constant current sources - Applying Kirchhoff's Voltage Law around each mesh For resistors, the law states: - If currents flow in opposite directions, subtract $i_{mesh 1}$ from $i_{mesh 2}$ - If currents flow in the same direction, add $i_{mesh 1}$ and $i_{mesh 2}$ - Voltage sources are represented by their value The loop current method is preferred when dealing with non-planar circuits or shared current sources between meshes.