SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A++ Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 23EET206/ Measurements and Instrumentation

II YEAR / IV SEMESTER

UNIT 3 - ELECTRICAL AND ELECTRONIC MEASUREMENTS

Topic 1 – Magnetic measurements: Determination of B-H curve

SUCCESSFUL STUDENT

| Positive Attitude | Professionally Groomed | Socially Interactive | Technically Skillful |

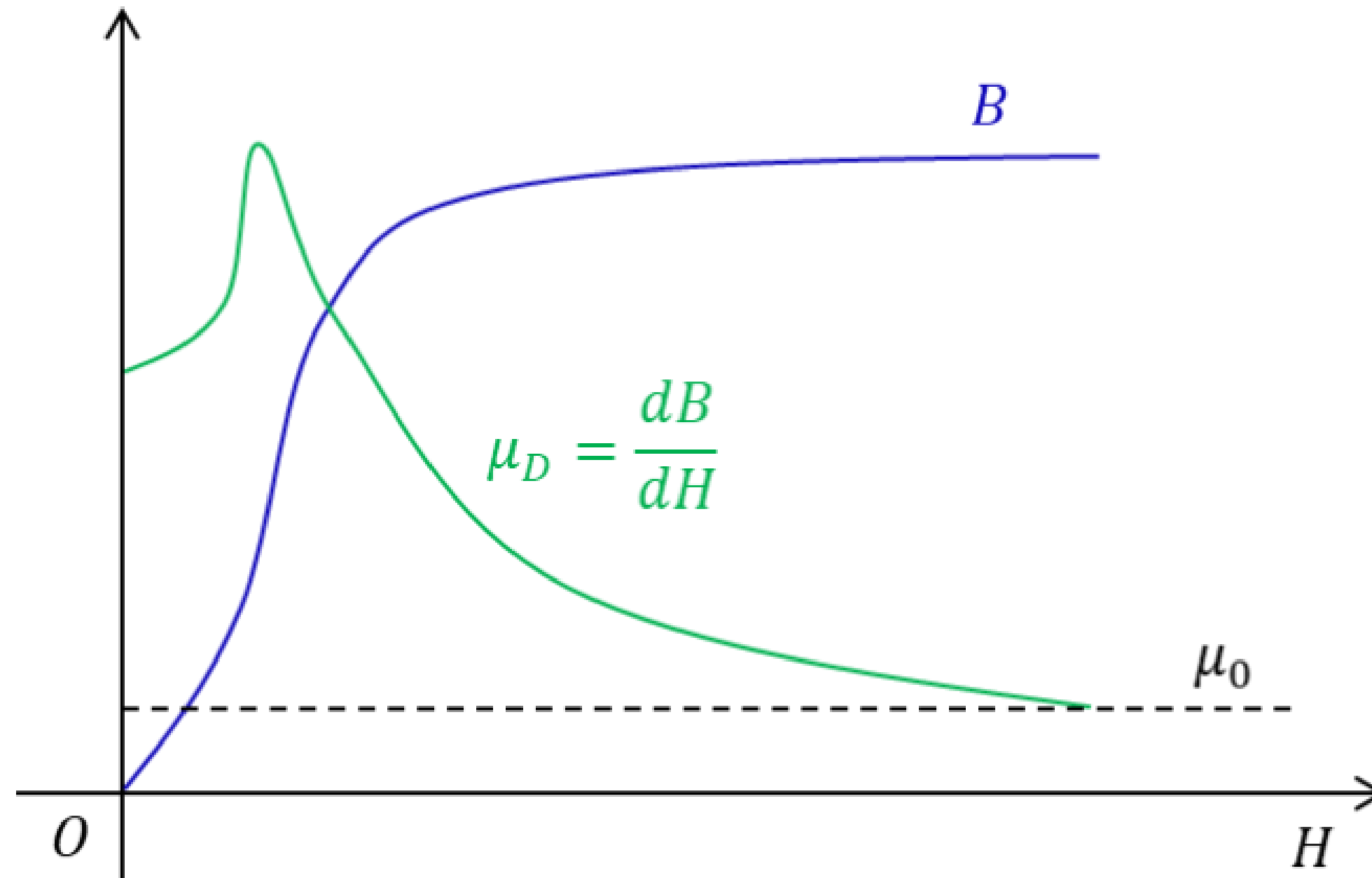# The B-H Curve, Permeability, and Differential Permeability

Magnetic soft iron steels are widely used as core materials in motors, transformers, and inductors. If they are placed in a region without magnetic fields, they will remain without a magnetic field; they do not have an "intrinsic" magnetization. The B-H curve is usually used to describe the magnetization properties of such materials by characterizing the permeability μ, which is defined as:

$$\mu = \frac{B}{H},$$

where B and H represent the magnetic flux density in tesla (T) and the magnetic field intensity in ampère per meter (A/m), respectively.

COMSOL Multiphysics has more than 200 built-in materials with B-H curves. Specifically, the *Nonlinear Magnetic* material library covers most of the widely used nonlinear magnetic materials. COMSOL Multiphysics usually uses an interpolation function with a local table to define the B-H curve. You can also plug in your own B-H curves by adding the *B-H Curve* material property to a new magnetic material.

The B-H curve of a material can be measured in the laboratory by following standards and procedures. However, it is difficult to perform a direct measurement when B is above the saturation induction, which is referred to as the overfluxed region. Generally, it is difficult for test equipment to reach such a high level of stable B; for instance, 1.8 T. Even if the test equipment can do so, the measured data will typically be inaccurate due to the test frame getting overheated. For this reason, the B-H curve data in the overfluxed region is usually obtained using extrapolation methods; for example, the simultaneous exponential extrapolation (SEE) method (Ref. 1).
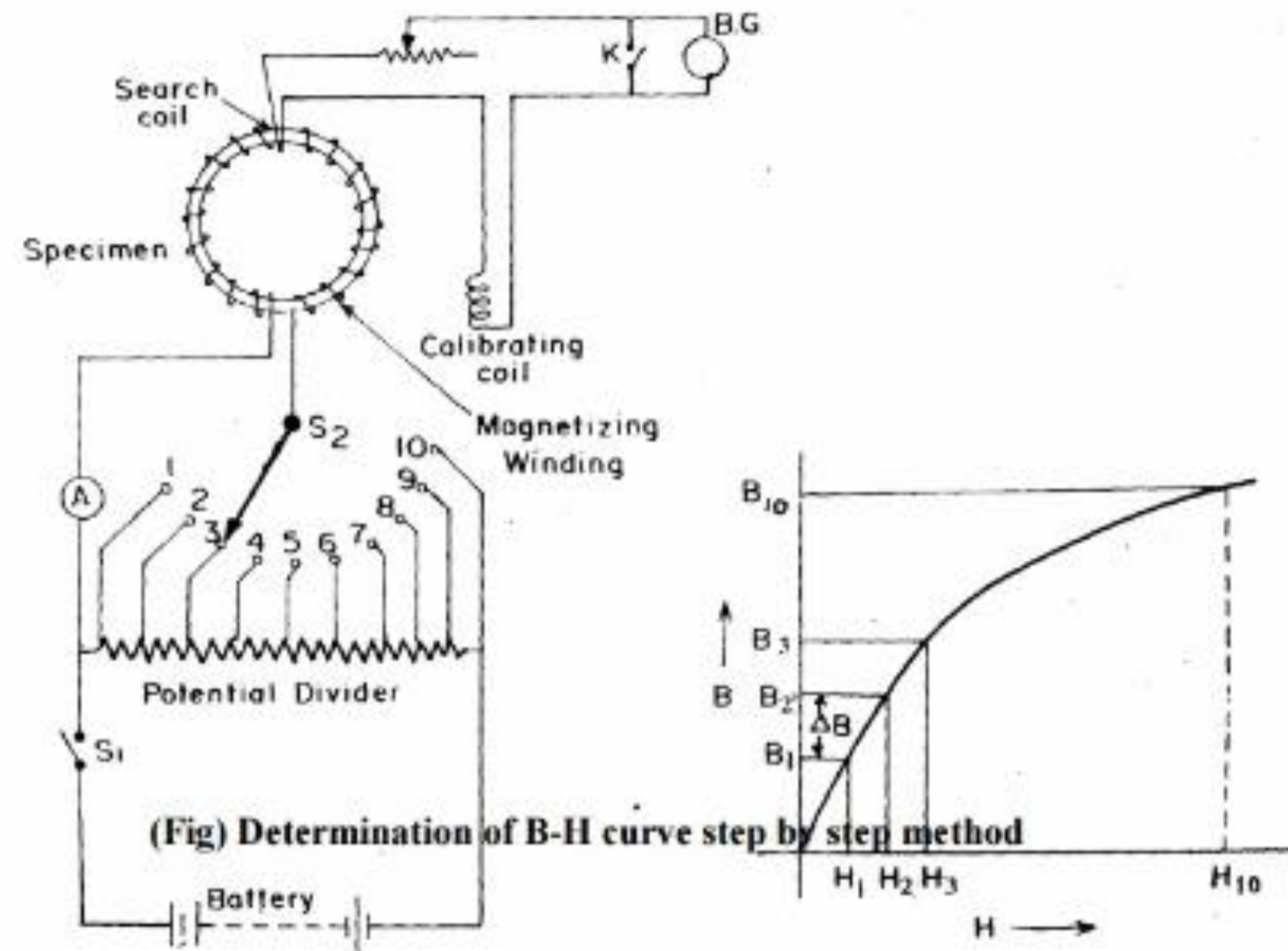
The schematic diagram of a typical B-H curve and the corresponding differential permeability as a function of magnetic field intensity.
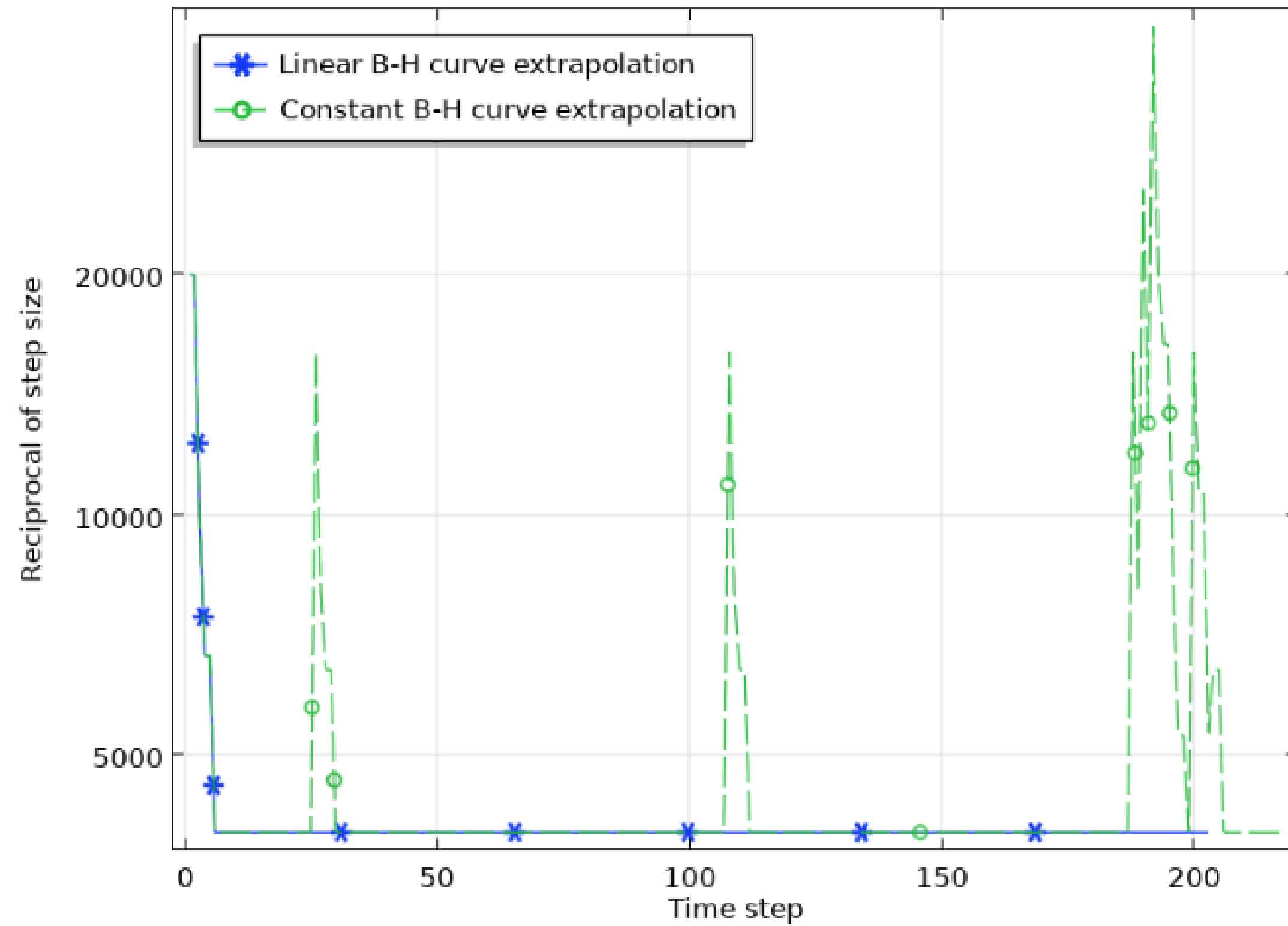
The convergence plot of the simulation with a linear and constant B-H curve extrapolation.

(Fig) Determination of B-H curve step by step method
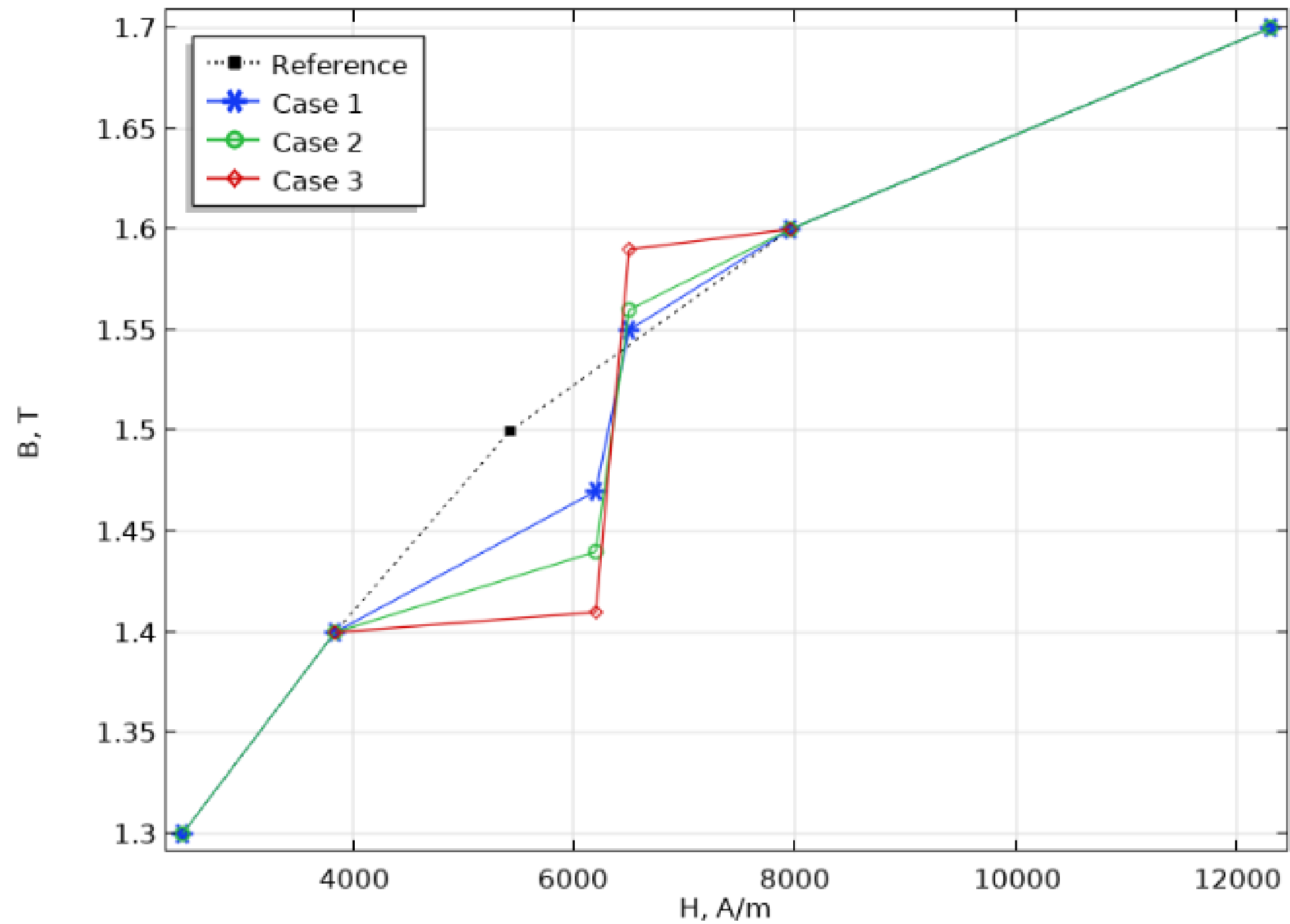
ASSESSMENT

REFERENCE

TEXT BOOKS

T1   A. K. Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai & CO., New Delhi, 2022.

T2   S. Gupta and J. John , "Virtual Instrumentation using Lab VIEW", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010.

REFERENCES

R1   David A.Bell, "Electronic Instrumentation and Measurements", Oxford Higher Education, 2013

R2   Bouwens A J, "Digital Instrumentation", Tata Mc Graw Hill, New Delhi2016

R3   Martin U. Reissland, "Electrical Measurement – Fundamental Concepts and Applications", New Age International (P) Ltd., 2015

R4   J. B. Gupta, "A Course in Electronic and Electrical Measurements and Instrumentation", S. K. Kataria & Sons, Delhi, 2013

R5   M. S. Anand, "Electronics Instruments and Instrumentation Technology", Prentice Hall India, NewDelhi, 2012.

WEB REFERENCES

W1   https://pasargadabzar.com/wp-content/uploads/2022/04/Morris_Langari-1.pdf

W2   https://www.vssut.ac.in/lecture_notes/lecture1423813026.pdf

W3   https://hombredelamancha.com/products/ebook-electrical-and-electronic-measurements-and-instrumentation?srsltid=AfmBOorTb5k9Ga1rsImj69-l3SximYYra7U8VhGcqYahqsfk9BR9rC7k

THANK YOU!!