MA 286 Analysis (= Calculus)

Aim: Explain and apply the generalised Stokes formula

$$\int_{\partial S} \omega = \int_S \partial \omega$$

where:

- ω is a differential p-form in n variables
- S is a nice region in $\mathbb{R}^n$
- ∂S is the boundary of S
- $\int$ is an integral

We'll try to understand underlined terms during the course.

Stokes

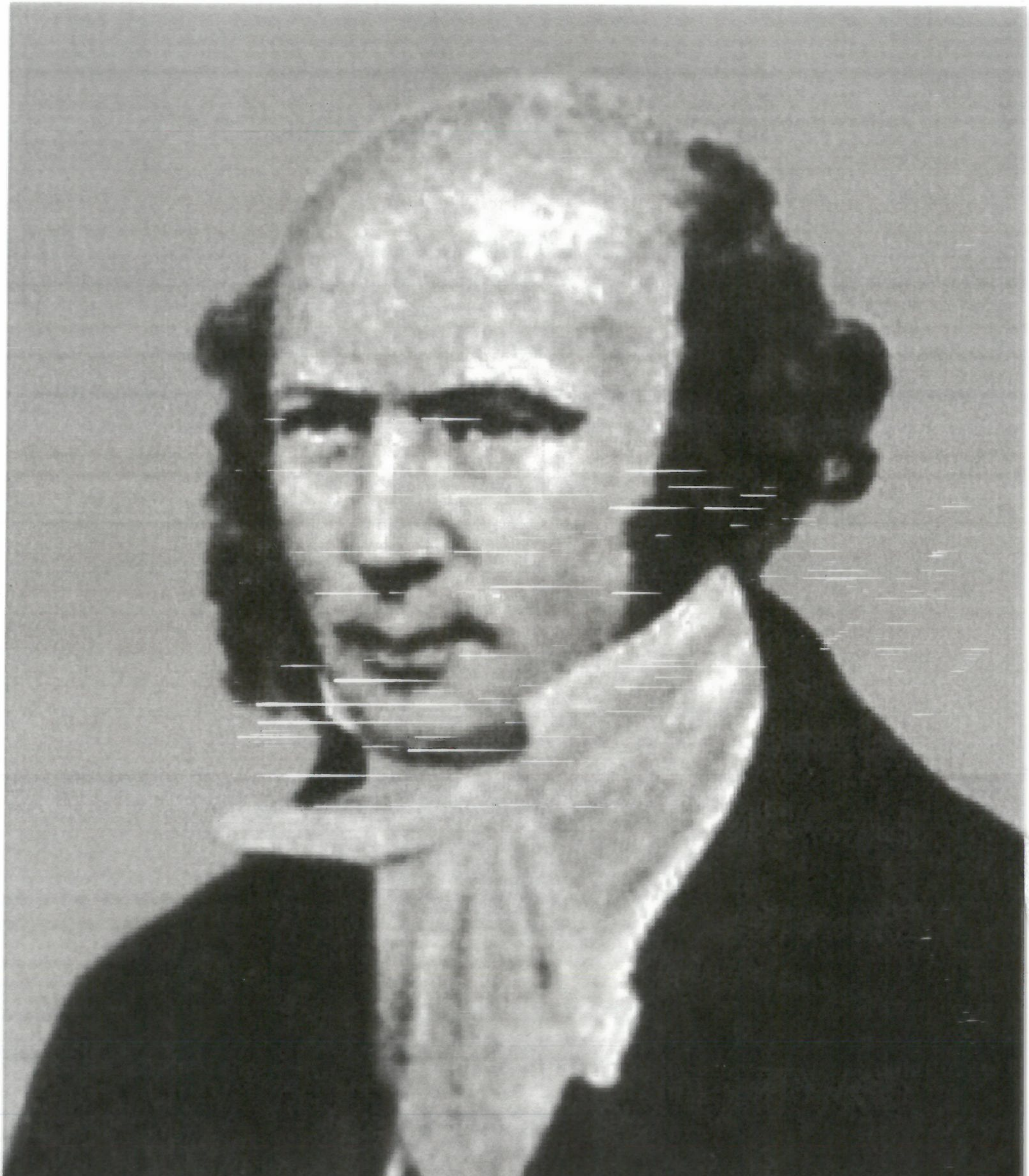
- Born in Sligo
- Lucasian Professor of Maths

(as were: - Steven Hawkins
- Isaac Newton
- Joseph Larmor)

Course will cover same topics as previous years, but with a different approach:

- Previous years treated only $p = 1, 2$ and $n = 2, 3$. This year we treat $p \geq 0$, $n \geq 1$.

- Previous years used vector notation of Hamilton.



Hamilton

- We'll use Élie Cartan's notion of a <u>differential p-form</u>.

Reason's for me replacing Hamilton by Cartan:

- Minimizes overlap with MP231 methods for applied maths.
- provides simpler and unified mathematical presentation of:
  - Fundamental Thm of Calculus ($p=0, n=1$)
  - Green's Theorem in the plane ($p=1, n=2$)
  - Stokes' Theorem ($p=1, n=3$)
  - Gauss's Theorem ($p=2, n=3$)

- differential p-forms in n variables are better suited to higher dimensions.

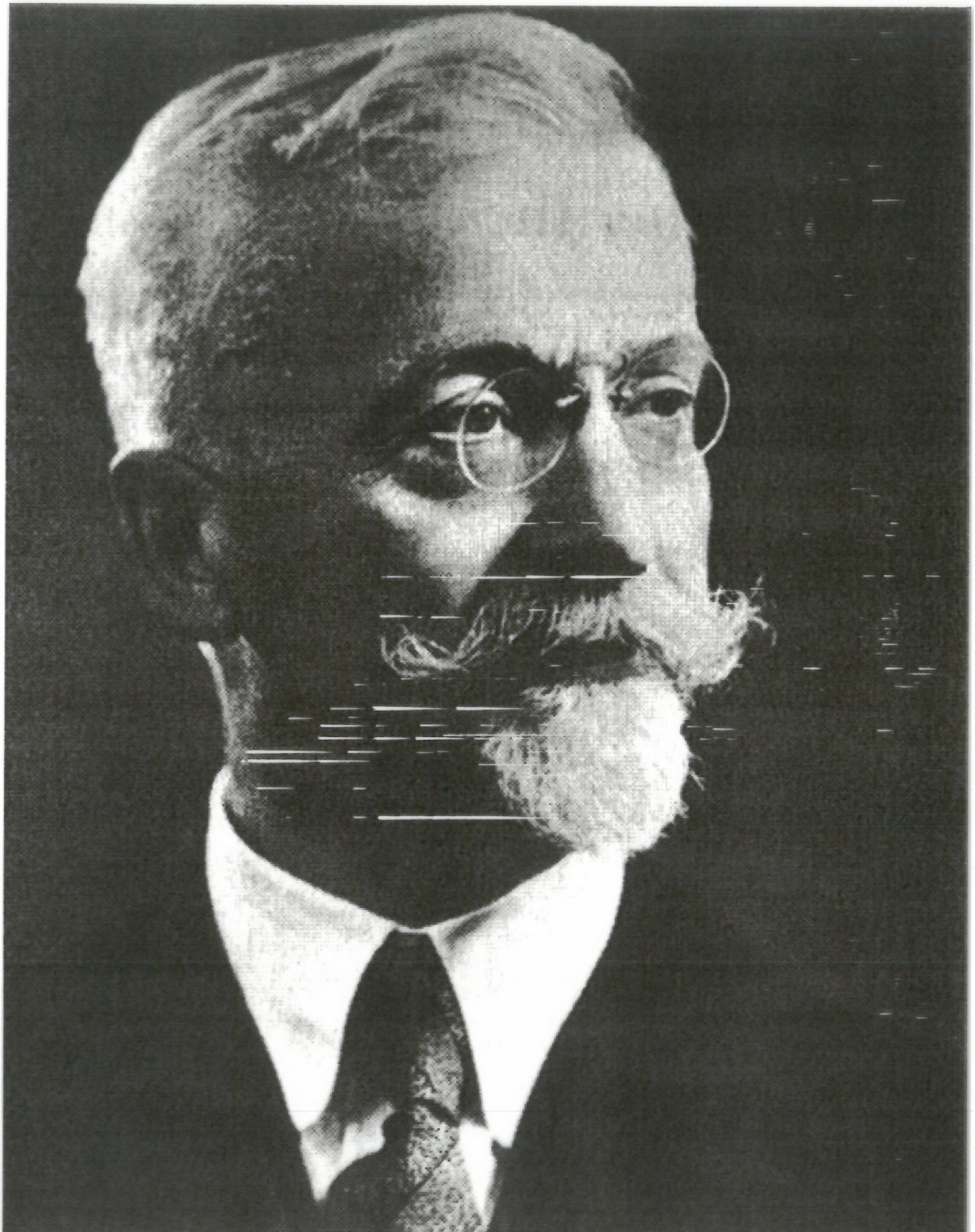
- "Big data" requires us to work in $\mathbb{R}^n$, n large.

  e.g. a 2-dimensional colour digital image should be thought of as a function

$$f : \mathbb{R}^2 \longrightarrow \mathbb{R}^3, \quad (x, y) \longmapsto (r, g, b)$$

(x, y): position of pixel

(r, g, b): colour of pixel



Cartan

Text:

Advanced Calculus by
M. Spiegel (Schaum's Series)

Background reading:

Advanced Calculus: A Differential
Forms Approach
by Harold M. Edwards

Module Assessment:

Continuous Assessment (30%):
three in class tests

Final 2 hr Exam (70%)

Most test & exam questions
will be taken from homework
sheets.

Most homework sheet questions
taken from Schaum book.