Contextualising the Curriculum Through the History of Mathematics: An Online, Open Access Resource

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LMS Education Day
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Why ‘Contextualise’ the curriculum?

- Awarding Gap at The Open University

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- Demand for ‘history of the gender gap’ talks

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- Enriching the curriculum
- Decolonising the Curriculum

A database of primary sources

- Image(s) of the source to be looked at

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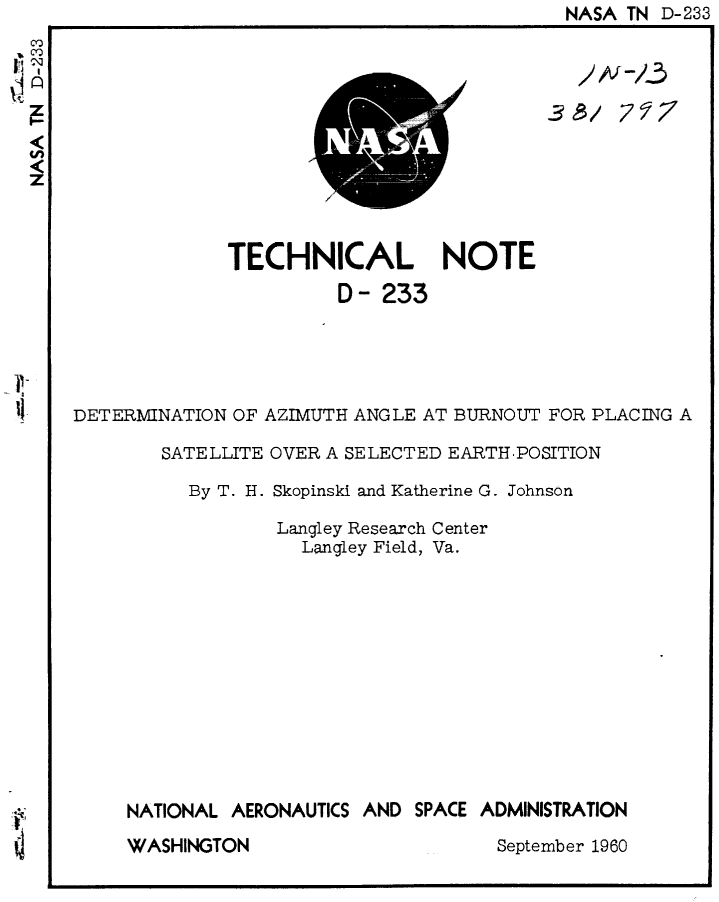
- Tags for making the database searchable

Organising/tagging the sources

- Mathematical
  - *Subjects*: geometry, calculus, algebra, applications, ...
  - *Ideas*: coordinate systems, functions, infinity, derivative, ...
- Geographical
- Language
- Chronological
- Biographical
- Other
  - *Other subjects*: Art, music, design, engineering ...
  - *Education*: Textbooks, lectures, examinations ...
  - *Communication*: Correspondence, journal article, learned society, congress/conference ...
  - *Target Audience*: Undergraduate, Sixth form/college, high school ...

Goble Johnson's Azimuth Paper



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NASA

TECHNICAL NOTE
D-233

DETERMINATION OF AZIMUTH ANGLE AT BURNOUT FOR PLACING A SATELLITE OVER A SELECTED EARTH POSITION

By T. H. Skopinski and Katherine G. Johnson

Langley Research Center
Langley Field, Va.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON September 1960

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

TECHNICAL NOTE D-233

DETERMINATION OF AZIMUTH ANGLE AT BURNOUT FOR PLACING A SATELLITE OVER A SELECTED EARTH POSITION

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SUMMARY

Expressions are presented for relating the satellite position in the orbital plane with the projected latitude and longitude on a rotating earth surface. An expression is also presented for determining the azimuth angle at a given burnout position on the basis of a selected passage position on the earth's surface.

Examples are presented of a satellite launched eastward and one launched westward, each passing over a selected position sometime after having completed three orbits. Incremental changes from the desired latitude and longitude due to the earth's oblateness are included in the iteration for obtaining the azimuth angles of the two examples. The results for both cases are then compared with those obtained from a computing program using an oblate rotating earth. Changes from the selected latitude and longitude resulting from incremental changes from the burnout azimuth angle and latitude are also analyzed.

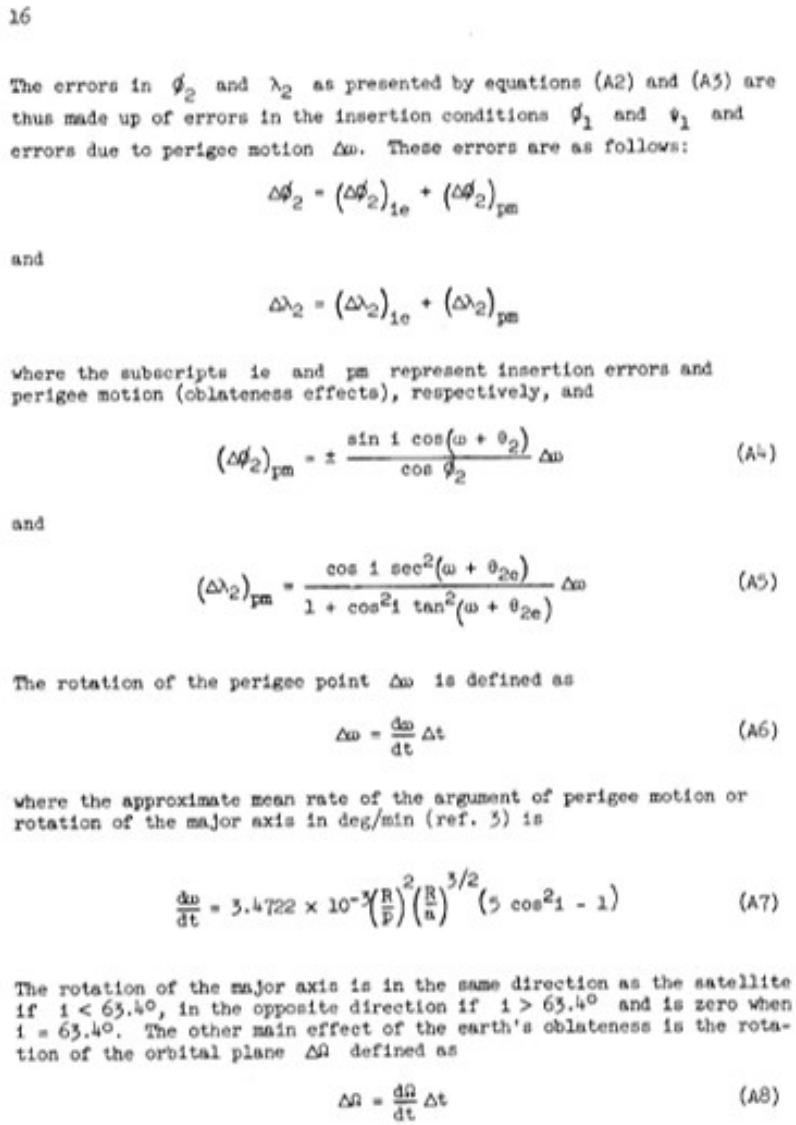
INTRODUCTION

In the recovery of an artificial earth satellite it is necessary to bring the satellite over a preselected point above the earth from which the reentry is to be initiated. It is the purpose of the present paper to determine the azimuth angle which must exist at a given burnout point in order to have the satellite vehicle pass over any particular earth position after a selected small number of orbital passes. For this purpose equations are developed which give the latitude and longitude of a point on the surface of a rotating spherical earth directly under the satellite at any time. An expression is developed which, with the orbit characteristics and the selected passage position on the earth's surface, will establish after only a few iterations the required azimuth angle at the burnout point.

Elliptical orbits about a rotating spherical earth are first assumed. Although this simplification ignores the effects of the earth's oblateness,

Online database of digitized NASA papers at: ntrs.nasa.gov/search

Seeing Research Mathematics



16

The errors in ϕ_2 and λ_2 as presented by equations (A2) and (A3) are thus made up of errors in the insertion conditions ϕ_1 and θ_1 and errors due to perigee motion $\Delta\omega$. These errors are as follows:

$$\Delta\phi_2 = (\Delta\phi_2)_{ie} + (\Delta\phi_2)_{pm}$$

and

$$\Delta\lambda_2 = (\Delta\lambda_2)_{ie} + (\Delta\lambda_2)_{pm}$$

where the subscripts ie and pm represent insertion errors and perigee motion (oblateness effects), respectively, and

$$(\Delta\phi_2)_{pm} = \pm \frac{\sin i \cos(\omega + \theta_2)}{\cos \phi_2} \Delta\omega \qquad (A4)$$

and

$$(\Delta\lambda_2)_{pm} = \frac{\cos i \sec^2(\omega + \theta_{2e})}{1 + \cos^2 i \tan^2(\omega + \theta_{2e})} \Delta\omega \qquad (A5)$$

The rotation of the perigee point $\Delta\omega$ is defined as

$$\Delta\omega = \frac{d\omega}{dt} \Delta t \qquad (A6)$$

where the approximate mean rate of the argument of perigee motion or rotation of the major axis in deg/min (ref. 3) is

$$\frac{d\omega}{dt} = 3.4722 \times 10^{-3} \left(\frac{R}{p}\right)^2 \left(\frac{R}{a}\right)^{3/2} (5 \cos^2 i - 1) \qquad (A7)$$

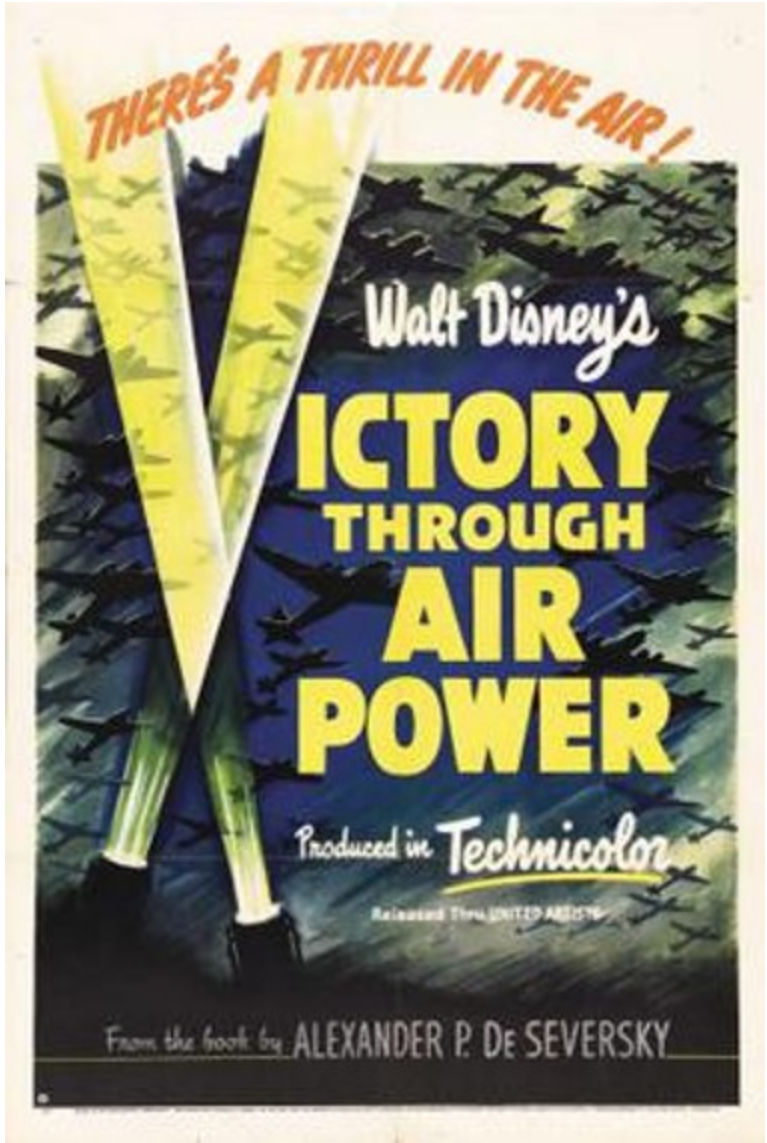
The rotation of the major axis is in the same direction as the satellite if $i < 63.4^\circ$, in the opposite direction if $i > 63.4^\circ$ and is zero when $i = 63.4^\circ$. The other main effect of the earth's oblateness is the rotation of the orbital plane $\Delta\Omega$ defined as

$$\Delta\Omega = \frac{d\Omega}{dt} \Delta t \qquad (A8)$$

Usual practice for these technical papers was that they would be combed through by mathematicians and engineers, to whom the authors would defend their results at editorial meetings spread over 10 months or more. This paper was the first instance of a woman in the Flight Research Division receiving credit as the author of a research report.

Mathematics and Global Politics

"This establishment [NACA] has urgent need for approximately 100 Junior Physicists and Mathematicians, 100 Assistant Computers, 75 Minor Laboratory Apprentices. . ."
Telegram, May 1943 [Quote from Page 1, Hidden Figures]

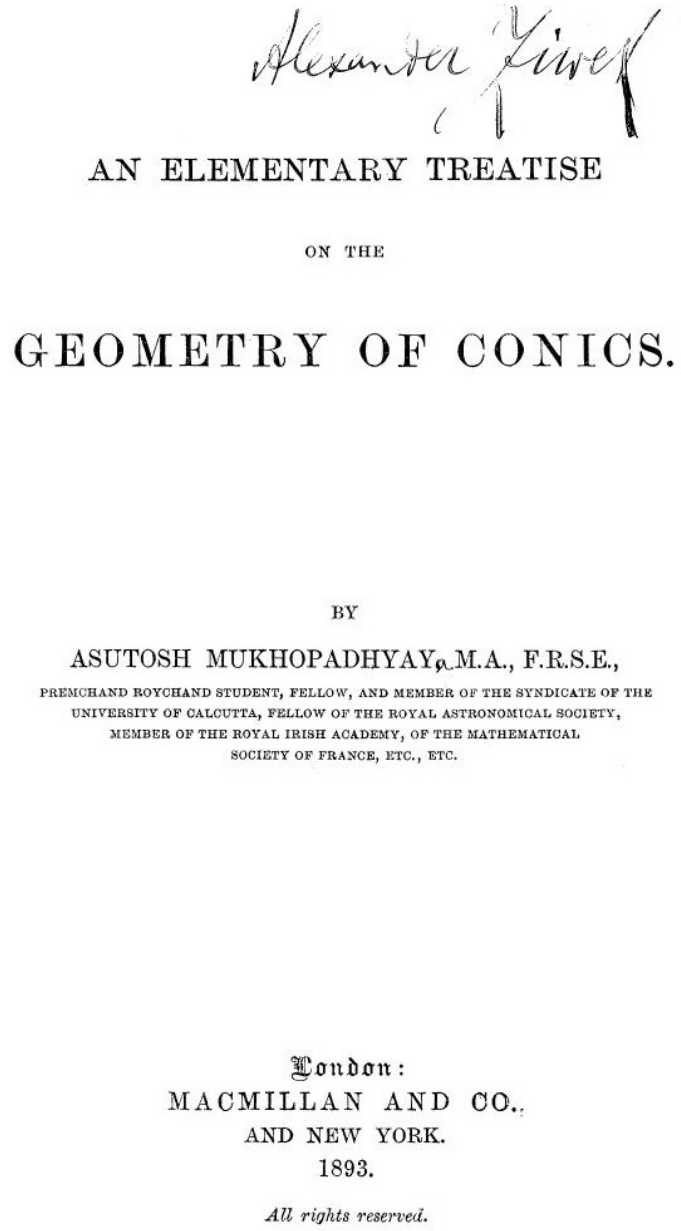


Gaining a mathematical education

"Around half of those in the Tier 1 workforce [where mathematical sciences qualifications are essential] have estimated salaries of £29,000 or above, compared with only 19% of the UK workforce."
'The Mathematical Sciences Pipeline', Council for the Mathematical Sciences. 2015. Page 53. Read online.

Mathematical Education in 19th-century British Colonies

‘The maths curriculum our students learn remains the same’, said a Durham spokesman in response to the Telegraph story. ‘But we also encourage students to be more aware of the global and diverse origins of the subject, and the range of cultural settings that have shaped it. Two plus two will always equal four.’



Alexander Ziwet

AN ELEMENTARY TREATISE

ON THE

GEOMETRY OF CONICS.

BY

ASUTOSH MUKHOPADHYAY, M.A., F.R.S.E.,

PREMCHAND ROYCHAND STUDENT, FELLOW, AND MEMBER OF THE SYNDICATE OF THE UNIVERSITY OF CALCUTTA, FELLOW OF THE ROYAL ASTRONOMICAL SOCIETY, MEMBER OF THE ROYAL IRISH ACADEMY, OF THE MATHEMATICAL SOCIETY OF FRANCE, ETC., ETC.

London:
MACMILLAN AND CO.,
AND NEW YORK.
1893.

Humanising Mathematicians

Sitting on the Female Bus

From 1950 to 1952, I was at the Princeton IAS. The institute was quite far from the town of Princeton. Hence the faculty and staff who did not own a car had to take a bus from Palmer square to the institute. There were two buses, one with a male driver and the other with a female driver. And this bus with the female driver would pick up the mail from the post office by Palmer square and deliver to the IAS. Now this was not a written rule, but when the male driver came, the men rode the bus and when the female driver came, the ladies rode on the bus. However, one day I was running late and waiting for the bus at Palmer square when the bus came with the female driver, and looking in, I saw there was still some room for 2 or 3. So I said "I'm in a bit of a rush, may I ride the bus?" but the driver answered "Don't you know this is the women's bus?". I immediately replied "I do know but I heard that you deliver mail as well." Entertained, the bus driver said "This Japanese is pretty clever," and I was able to make it on time.

Pleasant Mathematicians by Kentaro Yano, tr. by Shoo Seto.

Bibliography

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J. Barrow-Green. Wranglers in exile: Mathematics in the british empire. In *Mathematics in Victorian Britain*. Oxford University Press, 2011.

M. L. Shetterly. *Hidden Figures : The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race*. William Morrow: New York, 2016.

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