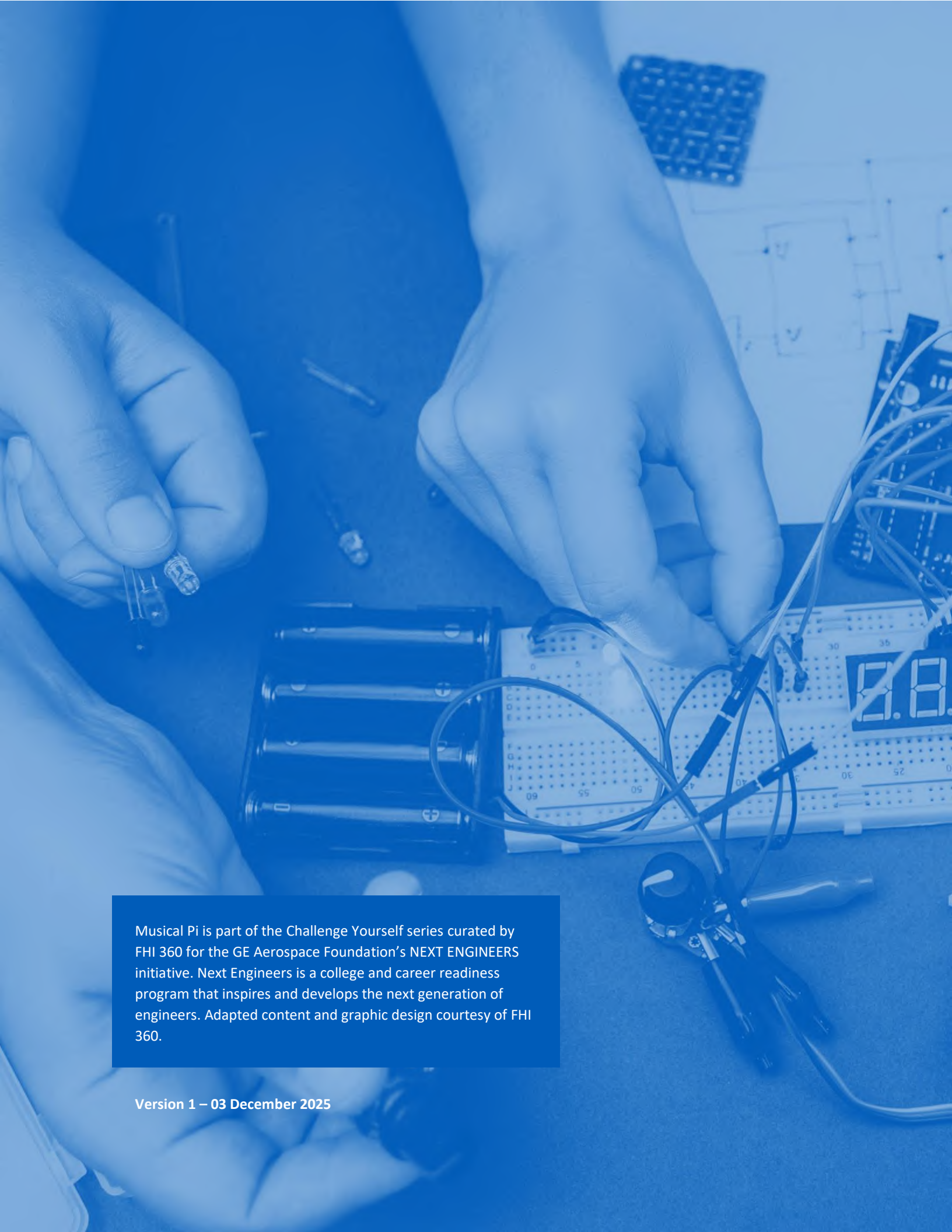
NEXT ENGINEERS

CHALLENGE YOURSELF

Pi Day: Musical Pi

All Engineering



Musical Pi is part of the Challenge Yourself series curated by FHI 360 for the GE Aerospace Foundation's NEXT ENGINEERS initiative. Next Engineers is a college and career readiness program that inspires and develops the next generation of engineers. Adapted content and graphic design courtesy of FHI 360.

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Musical Pi

NERD OUT

Mathematical music

Music and mathematics are very closely related. We can explain and describe how instruments make music, and even why some sounds don't sound like music at all, using mathematics. In a sense, musical instruments are mathematical instruments.

Marcus Miller does a wonderful job exploring the relationship between music and mathematics in his TEDx video *The Beauty of Math and Music* (20:26) (https://www.youtube.com/watch?v=K0jkbaJqL1s).

While mathematics is very good at explaining and describing music, can mathematics be used to create music? The short answer is yes! All modern electronic instruments and recording and mixing technologies rely on complicated mathematical algorithms to make and model music.

But what about in a more direct sense? For example, can π be used to create music? The answer again is yes!

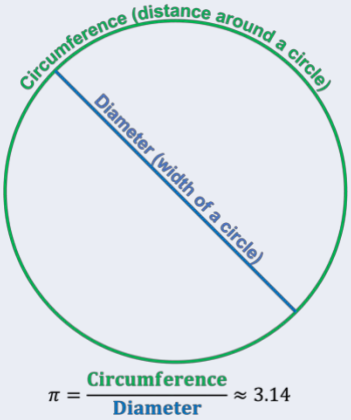
The sound of π

Several people have used the digits of π to create songs. Usually, they associate each digit (0, 1, 2, 3 etc.) with a note in the musical scale (C, D, E, F, etc.). Here are three examples of songs that have been written directly inspired by the digits of π.

- **Michael Blake**: *What Pi sounds like* (3:23) - In this video, Michael Blake describes his simple process for converting the first 32 digits of π into a song. https://www.youtube.com/watch?v=wK7tq7L0N8E
  David Scout: *Song from π!* (2:21) - This is the original video that David Scout posted to YouTube in 2011. The video includes many fascinating π facts as well. https://www.youtube.com/watch?v=OMq9he-5HUU
  - Listen to the studio version of *Song from π! (Studio Version)* (2:12) (https://www.youtube.com/watch?v=wM-x3pUcdeo).
  - If you would like to hear the story of how this song came to be watch *How I Wrote a Song With the Number Pi* (17:09) (https://www.youtube.com/watch?v=z7vovDiPjW4). A newer recording of the songs starts at 14:26.
  - You can download the sheet music for free at https://drive.google.com/file/d/1mF9ydrLxkAp4OC9wwRD-iKJ24C_okrit/view.

WHAT IS PI?

Pi (represented by the Greek letter π) is the ratio of the length of a circle's circumference to its diameter and has a value of approximately 3.14.



LEARN MORE

To learn more about the deep relationship between music and mathematics read this paper called An *Exploration of the Relationship Between Mathematics and Music* (http://eprints.ma.man.ac.uk/1548/1/cov).

- **Canton Becker**: *Pi Songs* -Canton Becker has created two very long songs based on π. The first was Shephards Pi in 2019 (a million hours) followed by Techno 2020 (114 years). You can listen to both songs at the website above. https://pisongs.com

Visit *Pi and Music* (http://www.pi314.net/eng/musique.php) to learn about a few other π-inspired songs.

Are you ready to try your hand at writing your own π-inspired song? Choose your key, assign the digits of π to different notes and chords, and choose a rhythm and tempo. Share your beautiful π music on social media using **#NextEngineersDIY**.