Welcome

In this lecture, we are going to illustrate how to compute a volume.

We will cover:

- An introduction to our live web application
- How to input some scalar values to get an output scalar volume
- How to subtract one volume from another (to mimic a more complex volume)
- How to distribute and share a volume dataset with other engineers
- Discussion on why subtractive volumes are important for imperfections

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Volume.cc

Measure a geometric…

“Today, you’ll learn the basics. And tomorrow you’ll be an expert.”

Here we have a drinking glass and we’ll use it within this lecture

Now many of us have access to a tumbler and it just so happens that it actually mimics a geometric equal to the cylinder

If we wanted to calculate its volume, we need two input scalars from the object. These include its diameter and its height

Now given that the walls on this glass are of no interest. We calculate what we term its hollow cylinder. It’s the same cylinder but minus the wall width twice. We’re left with an inner diameter as opposed to its outer diameter

Using a well defined formula, we can compute its volume: $V = \pi r^2 h$ … where r is equal to one halving of the inner diameter

Given an inner diameter equal to 6.1 cm (r=3.05) and a height of 13.2 cm. The volume is equal to 385.765587 cm^3

Recall from the first lecture that multiple linear scalar inputs produce a singleton scalar output

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Calculate a volume manually…

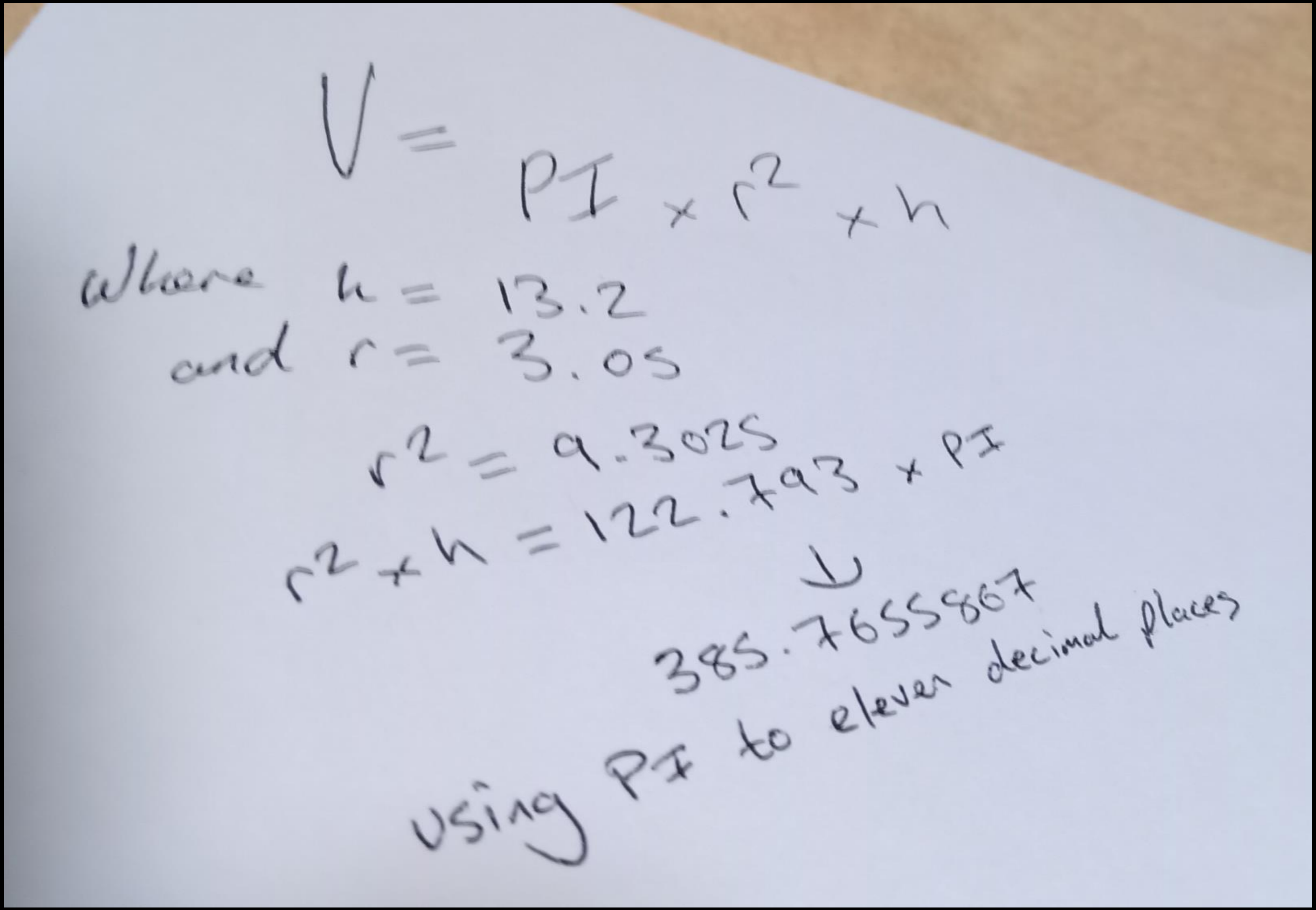
These volumes can be calculated by hand using a calculator albeit its certainly prone to human error

In addition the precision of value PI here indeed will dictate the level of accuracy achieved in its scalar output

Here a PI value with eleven decimal places is required to yield a scalar value which is precise to within seven decimal places

As we’ve witnessed, its a lot of work to solve a volume for an everyday object and this object is a relatively simple use case

As witnessed, multiple inputs into the formula result in one singular output



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Repeatable math standard…

Now our glassing drink in this case should be able to accommodate 385 millilitres (ml = cc) of fluid. This is equal to 38.5% of a litre and exceeds the common capacity of a soda can which is often equal to 330ml.

Through this repeatable experiment, we’ve already witnessed one benefit. We have a repeatable benchmark to assess whether our drinking glass is suitable for the standard soda can found in most stores. Since we’ve measured our drinking glass, we could take this tumbler anywhere and rest assured that it will be able to accommodate any soda can with a capacity less than 385 millilitres.

Now lets put it to the test and this experiment can always be used as a fallback to make sure we never break any past repeatable standard. If we were to fill a calibrated measuring jug with 385 millilitres of fluid, it should in theory be able to fill our tumbler with minimal to zero overflow. If it does not then the formula we’re using is not well defined. Since we know it is defined, it will only fail if the jug is not calibrated (common problem) or imperfections exist in the circumference. When we do this and get a good outcome, we can repeat it and it illustrates the concept that repeatability matters because with a repeatable test standard, we have consistency! And consistency makes everyone comfortable with everything… it works and will continue to work…

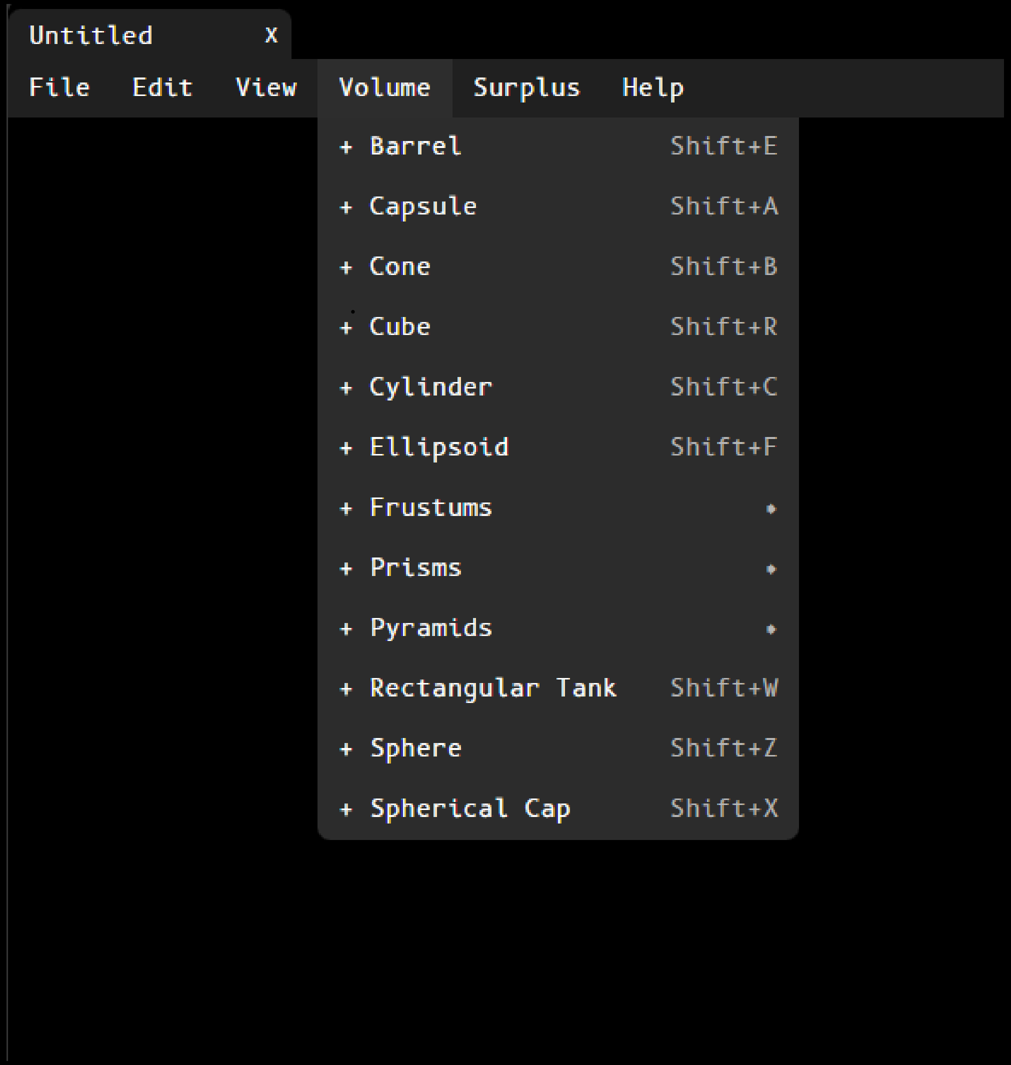
Using Volume.cc...

Our web application comes packed with a collection of well defined volumes and features.

It offers all the ability to:

- Load and save datasets locally
- Load and save datasets through our cloud (mobile engineer)
- Export datasets on to our live protocol to share globally
- Make complex unconventional volumes for niche use cases
- Define and store repeatable surplus volumes

Many conventional volumes may be accessed through the Volume menu evident upon render. To illustrate the ease of our calculator, we can repeat the drinking glass experiment which we covered in the past couple of lecture slides



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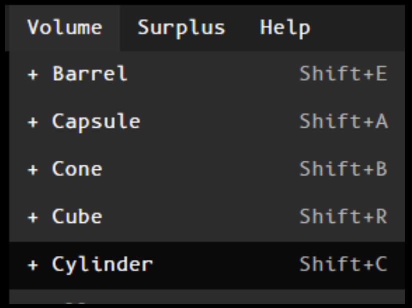
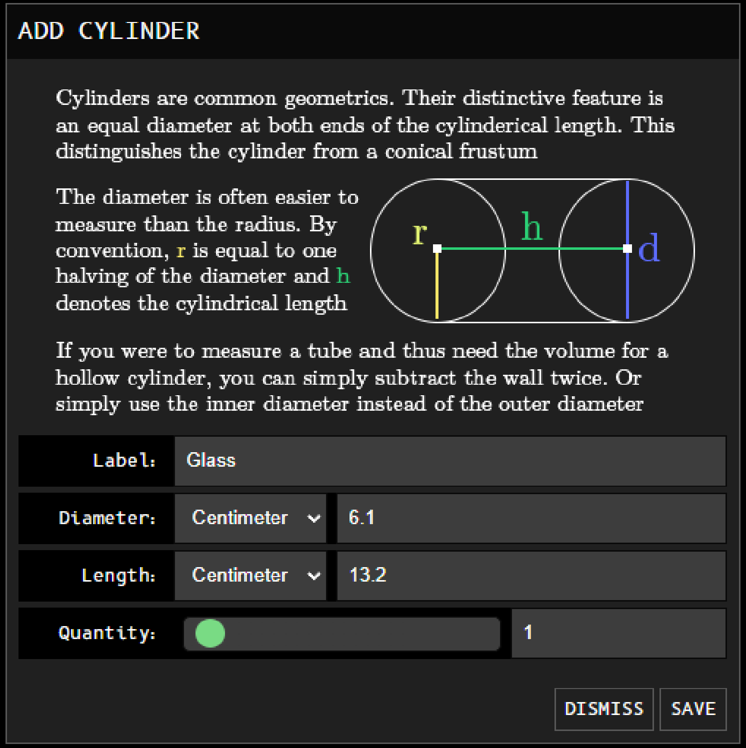
Using Volume.cc...



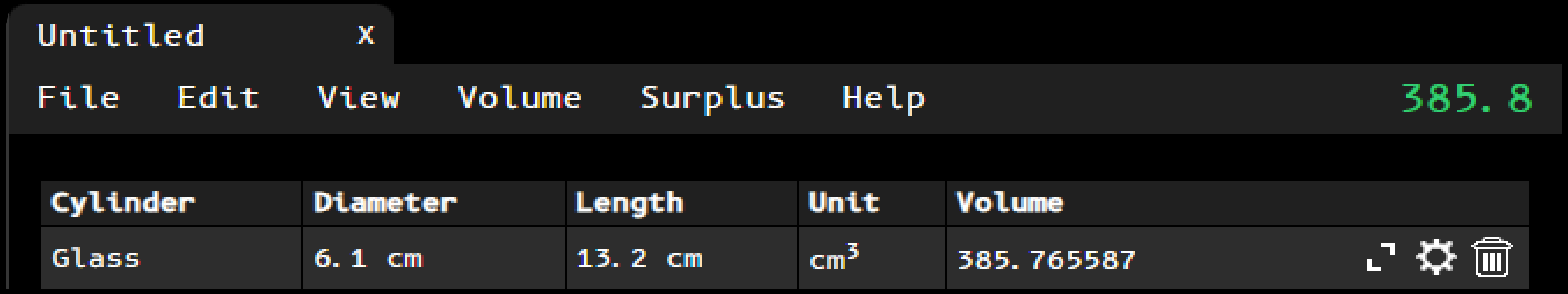
Given a hollow cylinder with a diameter of 6.1 cm and a length of 13.2 cm. We can select the “Cylinder” volume type from the sub menu which appears below the “Volume” menu

Alternatively we may utilise any of the hotkey shortcuts which appear on the right side of this sub menu. In this case, we could hold shift and press the “C” key



Upon selecting a volume type from the menu, a dialog will appear. Our service allows anyone to solve volumes if they provide scalar inputs with a distinctive label

After input of a suitable label and accompanied by its scalar inputs, the application will solve the volume for you. The accuracy of the volumes produced is extremely high and a lot more precise than what would alternatively be practical



Subtractive Use Case…

Here we're going to illustrate a use case when given an imperfect spatial complexity between two objects. We'd need to estimate a 3-dimensional space and the only way to pragmatically achieve this is through estimation.

We can consider the banjo fitting which is often accommodated with a hollow screw in. If we wanted to estimate the spatial complexity range between the inner wall of the banjo and the outer wall of the hollow screw cylinder, we would indeed need to subtract one volume from a higher master volume.

The higher master volume in this case would be the banjo because without the hollow screw in, the spatial complexity would still exist. Should this screw in insert itself through the banjo's opening, then it should indeed act as a subtractive and the master volume should subtract the attached volume. Volume.cc facilitates this where we can utilise an ellipsoid to represent our banjo and add a cylinder as the subtractive for the hollow screw in.

In this instance, our data informs us that the spatial complexity range between the inner banjo wall and the outer wall of the hollow screw in is equal to 130.9 cc (ml). The same technique can be used to estimate the volume of a tyre.

Subtractive volumes offer incredible value.

File Edit View Volume Surplus Help 130.9

Cylinder	Diameter	Length	Unit	Volume
hollow_screw_in [-1x]	5 cm	4 cm	cm^3	-78.539816

Ellipsoid	Axis A: X	Axis B: Y	Axis C: Z	Unit	Volume
banjo_fitting	5 cm	5 cm	2 cm	cm^3	209.43951

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Suppose we need to subtract one object from another. We first add the subtractive object as we would any other regular object.

Untitled X

File Edit View Volume Surplus Help 1000

Cube	Edge Length	Unit	Volume
tank_half [-1x]	10 cm	cm^3	-1000

Rect. Tank	Length	Width	Height	Unit	Volume
tank	20 cm	10 cm	10 cm	cm^3	2000

The scaling for any object may be changed through the scaling icon illustrated here

We next may change its scaling. Setting an objects' scaling = -1 means it is indeed acting as a subtractive. This allows any engineer to subtract one volume from another.

Scaling for each object may be set within the interval [-1, 1]. By default all objects begin with a scale set to 1.

If the overall summation of objects ever dips below 0 due to subtractive volumes, the actual final volume visible in the top right of the calculator will safely default back to zero.

It's not possible on our platform to have negative volumes.

SCALING CHANGE: TANK_HALF

Modifying the scale of a volume object permits a portion of a typical object and subtracts the remainder from an existing recipe. By default, most scales will initially be set to one.

Scale: -0.89

DISMISS UPDATE

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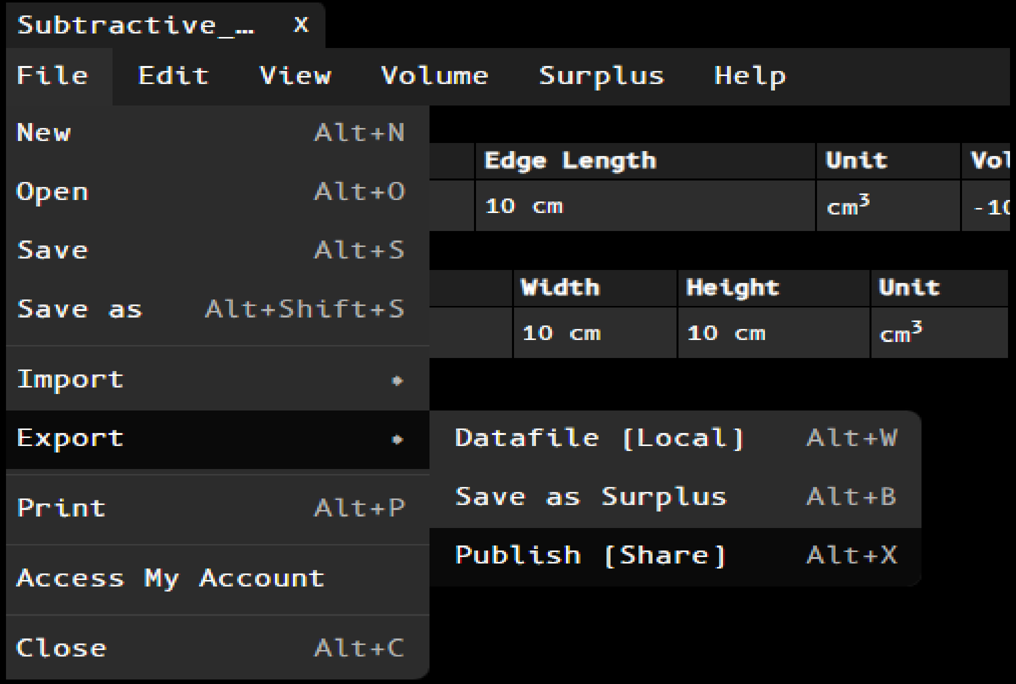
How to Share a Dataset…

Our platform makes it easy to distribute datasets to other engineers.

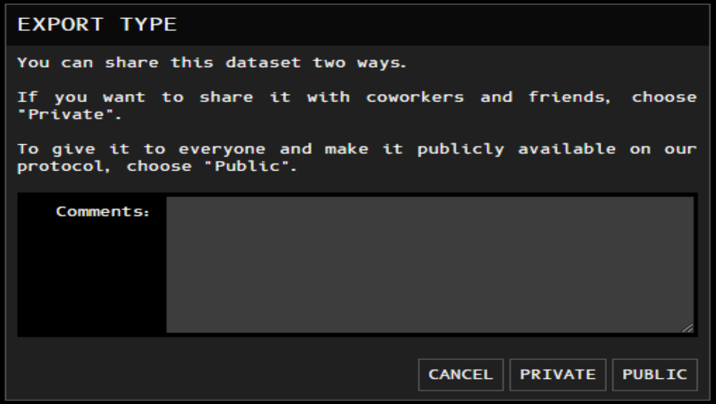
Given the subtractive example illustrated on our right, we can quickly dispatch this through the protocol using the export option found within the File menu.

File -> Export -> Publish (Share)



There are two ways a dataset can be exported. Public exports appear on our search index and are accessible by the public through the register. If you choose "PRIVATE", the dataset will not appear in the register and will only be visible to recipients who receive from you a unique URL.

You may add comments to the dataset before the export takes place. These comments will be visible to users accessing the dataset through your URL.



Once exported as either a public or private volume, the platform will provide you with an unique URL and ID for the export submission.