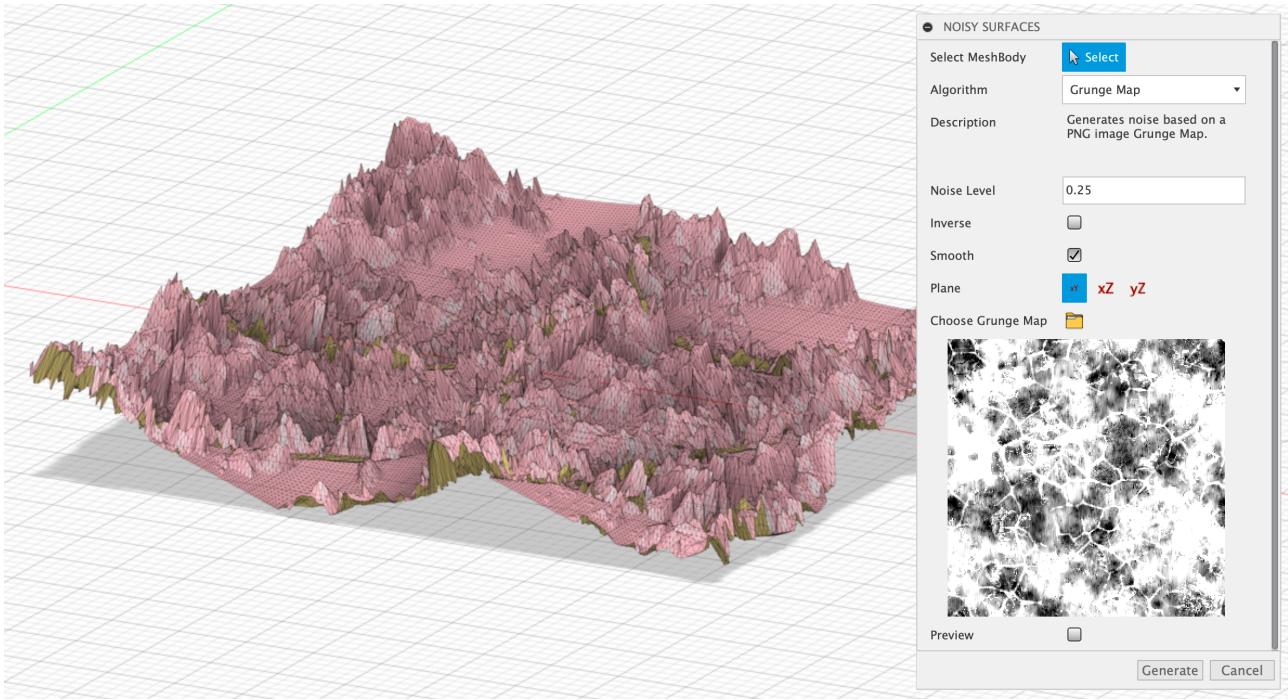


Media Computing Project – Noisy Surfaces

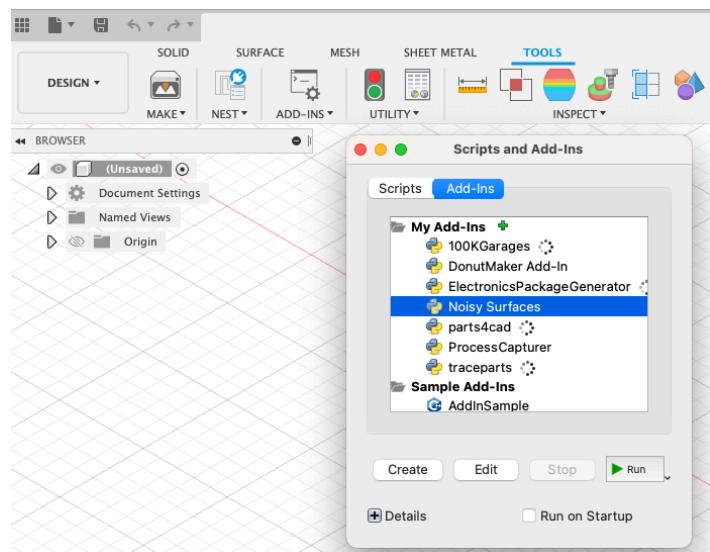
When creating and modelling 3D objects, it is important to have a variety of easy-to-use editing tools that allow for extensive modifications. The Noisy Surfaces plugin for Fusion360 offers just that: Numerous options for customizing surface noises and distorting *any* object in Fusion. By simply using an existing mesh or converting an object to a mesh, it is possible to apply the plugin. Then it is possible to choose between five different filters, to create a turbulent, patterned-like, self-customised, or uneven surface. The result is a customised, optionally highly detailed, more natural looking 3D model, within a few clicks.



Installation

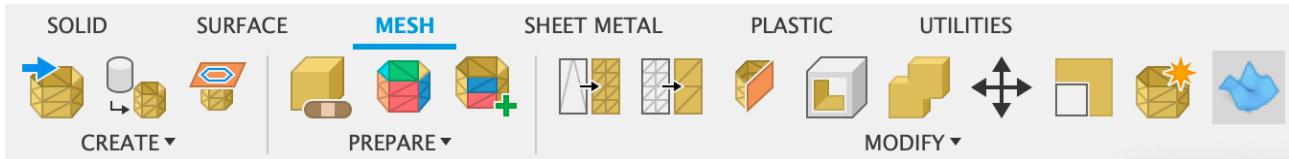
The Noisy Surfaces plugin works with Autodesk Fusion360 on Apple macOS and Microsoft Windows. The installation can be done by following these 7 steps:

1. Start Autodesk Fusion360
2. Select the Tools tab in the design menu
3. Open the Scripts and Add-Ins submenu
4. In the Add-Ins tab: Click the small green button next to "My Add-Ins" which opens the Add-in file system as a popup window
5. Unzip the downloaded Noise Surface Add-In folder and drag into the Add-in popup window of Fusion
6. The Scripts and Add-Ins submenu now displays the Noise Surface Add-In, which can be executed.
7. The Noise Surface button to apply Noises to meshes can be found in the mesh tab



For further help please refer to the general instructions on AddIn installation as provided by Autodesk

How to Use

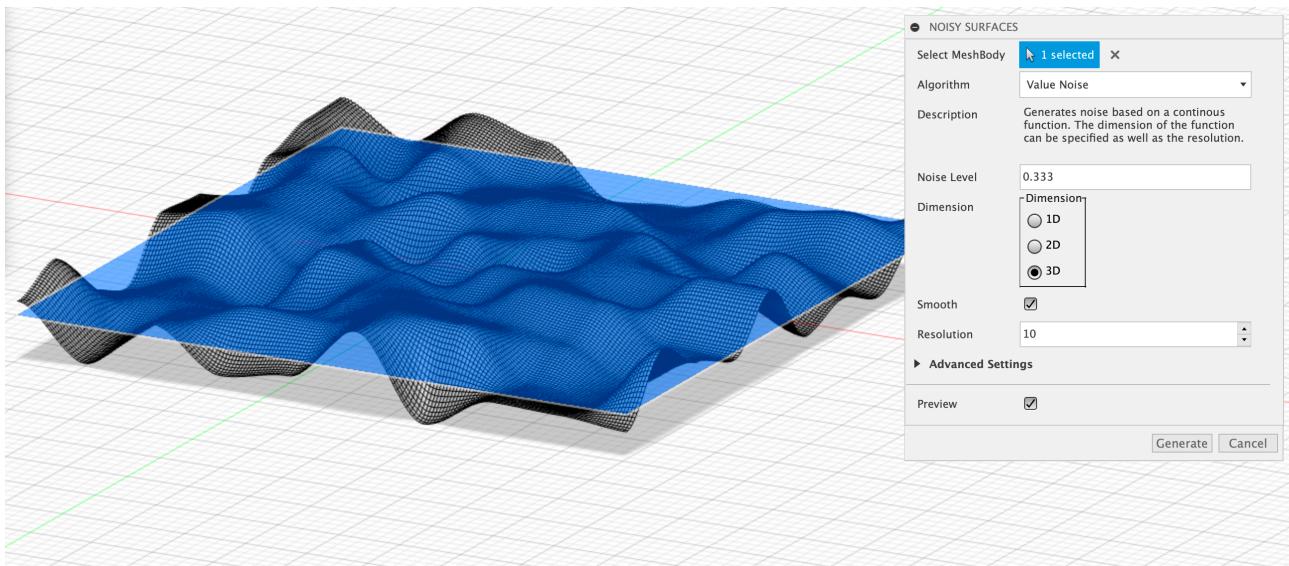


Noisy Surfaces can only be applied to meshes. Therefore the plugin button is located in the 'Mesh' tab, under the 'Modify' panel. If there is not a mesh to begin with, Objects can simply be translated to meshes by using the "Tessellate" function. This function also allows to determine how many polygons the resulting mesh should contain (Maximum Edge Length). The number of polygons in the mesh determines the resolution of the resulting surface noise. However, it should also be noted that a high number of polygons can impact the performance.

By clicking the Noise Surface button, it opens the noise GUI to select one or multiple mesh. In the below drop-down menu it is possible to choose between 6 different Noise functions, which allow different noise shapes and a variety of settings for those noises. This is followed by some noise specific attributes to change the appearance of the selected noise. In the section "Plugin description" we give a more detailed look into every Noise function. The bottom of the GUI displays a Preview checkbox, that enables a preview of the currently selected noise with the currently used settings, to get a direct feedback.

Plugin Description

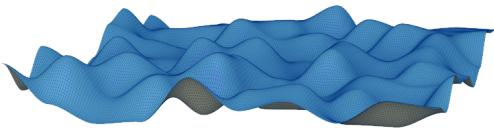
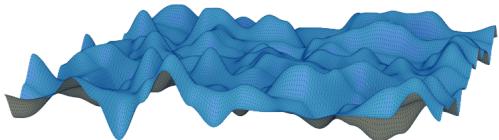
The Noisy Surface Plugin provides a simple user interface that allows a quick and easy way to apply various noise algorithms to 3D objects. In order to achieve the best fitting noise, the plugin provides 6 different noise algorithms with different functionalities and application areas. Some important settings are the noise level, to change the overall appearance and extremeness of feature points. The resolution to change the size of the applied noise in an area, and the



The Plugin in action. The active 'Preview' setting shows a preview of the result.

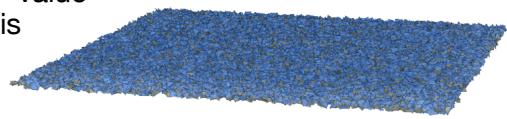
smooth setting to give feature points a smoother and more curved appearance. Another interesting tool is the seed setting under advanced settings, which allows to change the appearance of noises while keeping all other settings and allowing to find most appropriate distortion. Last but not least one of the most useful settings is the Preview option that allows users to see the changes that are done — almost in real-time — by modifying certain parameters of the noise algorithm. Most of the settings also have a tooltip description in Fusion360 while hovering over them.

Perlin Noise is one of the most classic noise algorithms. Its pseudo-random appearance, is based on a continuous noise function. The noise can be used to create a great variety of procedural terrain-like textures.



Value Noise is quite similar to Perlin Noise but interpolates between random integer values assigned to each point along a generated grid. This results in a bit smoother looking overall shape which especially gives good results even in a low polygon mesh.

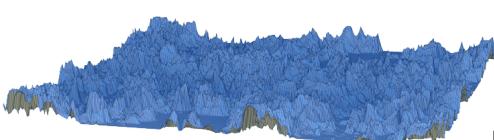
Random Noise assigns each mesh vertex a random value without any dependencies on its neighbouring vertices. This creates very rough and sharp surface turbulence, without any noticeable feature points. It is particularly useful for generating fine rough surfaces feedback.



Adaptive Noise works similar to random noise but respects polygon sizes, such that more detailed mesh areas are protected or optionally more distorted. This helps protecting fine areas like face details or fine corners of an object.

Worley Noise is a cellular texture-based algorithm that comes close to simulating textures of stone, water, or biological cells.

It distributes random feature points across the meshes surface and generates distortion based on the distance to the closest point. This is also the most computationally expensive algorithm. The additional option of the step function allows to create a scale like pattern.

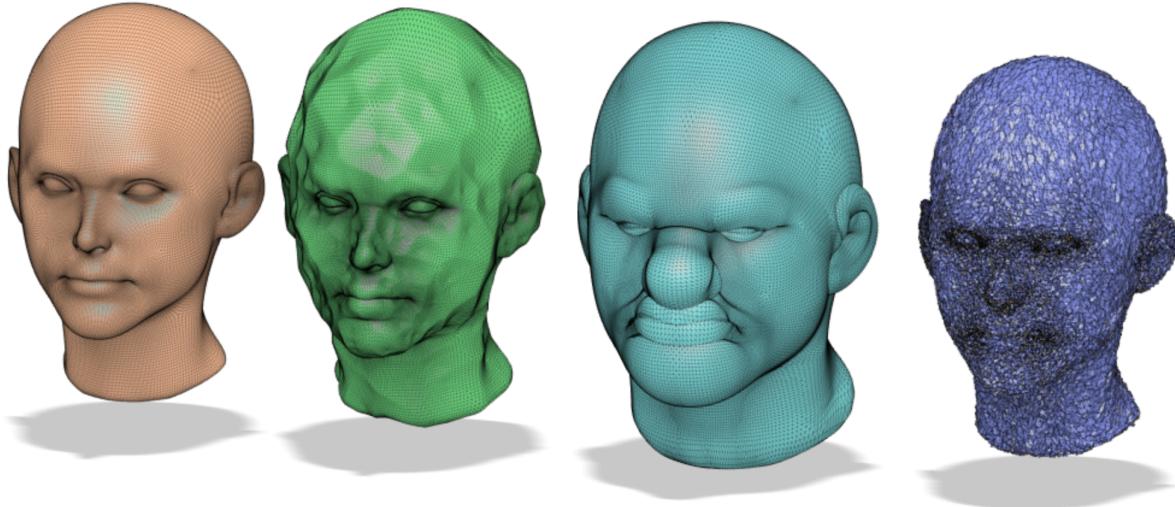


Grunge Map allows to work with individual noises, patterns or even textures based on PNG images. Therefore it allows to import a quadratic image into the Plugin which is then converted into a greyscale height map. The greyscale pixel values are then interpreted as the distortion height and mapped onto the mesh.

Usages - Limitations - Design Choices

When it comes to 3D modelling, Noises are an essential and powerful tool that many 3D software systems make use of. In general it is used to simplify the modelling process and allow for a more natural look of objects. It helps giving objects surface physics and a texture which does not depend on the material that is used to 3D print them. In general the plugin allows to generate rough, fine, smooth, detailed, natural looking or quite distorted surfaces with varying extremeness and characteristics.

The application area for this is broad and individual for every noise, as also covered in the plugin description section. For example, an organic looking surface can be achieved by using the Worley noise. To generate more pattern like designs or quite individual, pre-defined distortions, the grunge map functionality is a great tool to use. Any 3D object that is represented as a mesh body in Fusion360, can be used as input for the Plugin.



Different algorithms and parameter settings applied to the same object.

Regarding the design chooses, we tried to offer a GUI that works quite similar to all other GUIs in Fusion360, in order to allow a familiar feeling interaction. We also tried to keep the GUI as simple and self explanatory as possible by using key words and settings with a high user-friendliness. However, we did not oversimplify controls, to ensure a wide range of modification possibilities and a high precision of many controls, that allows to achieve optimal distortions — for both new users and experts. Since even small changes in certain noise settings can have a major impact on the overall result, we included a preview function that in most cases is able to show real-time results before finally applying the algorithms. To help even inexperienced users that do not have any experience with noise generation, we included tool tips for every setting and each noise algorithm. Last but not least we used a progress bar for performance intensive algorithms and operations to visualise the process and keep the user up-to-date.

As it comes to the limitations of the plugin, the noisy surface plugin is mesh based, which means objects must first be converted to a mesh body in order to apply the noise functions. This restriction is due to the fact that an automatic solid to mesh body conversion would require explicit knowledge of the use case and how finely detailed the desired mesh should be. This can be done meaningfully by the user themselves. Furthermore it is currently only possible to apply the noise to the entire object not to just some polygons.

Overall, Noisy Surfaces provides new ways to quickly create complex shapes for already existing objects to give them a special appearance. With a wide range of available algorithms and settings the possibilities are vast and easy to use. From natural, terrain-like surfaces, to extreme alienation of objects, Noisy Surfaces is the Plugin to use.