

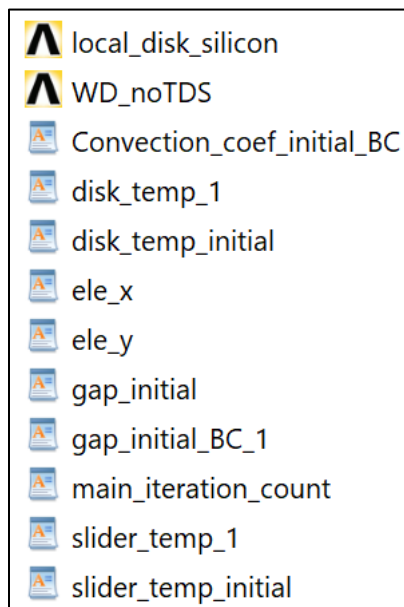
Instructions to Run the Static Touchdown Code

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1. Input Files











You will require the following input files:



- local_disk_silicon.db and WD_noTDS.db are the ANSYS FEM models for the silicon wafer and the slider respectively.
- ele_x.dat and ele_y.dat contain the x, y coordinates of each node of each ABS surface element of the ANSYS FEM model (WD_noTDS.db). The given ANSYS model has 754 triangular elements on the ABS surface. Each triangular element has 3 nodes.
- slider_temp_initial.dat, slider_temp_1.dat, disk_temp_initial.dat, disk_temp_1.dat are 754 x 3 size matrices with uniform value 25 °C (room temperature).
- gap_initial and gap_initial_BC_1 are 754 x 3 size matrices with uniform value equal to the initial spacing between the head and the silicon wafer. This value is set at 21.3 nm in the example baseline simulation.
- Convection_coef_initial_BC is the initial guess for the heat transfer coefficient in the HDI (again a 754 x 3 array). It is set to 114800 W/m²-K which roughly corresponds to 21.3 nm spacing.
- main_iteration_count.dat is set to 1 (iteration counter).

2. Program Files

You will require the following program files:

	disk_cal	MAC File
	HF_cal	MAC File
	maincontrol_broyden_loop	MAC File
	slider_cal_protrusion	MAC File
	get_htc	MATLAB Code
	initialization_routine	MATLAB Code
	initialize_broyden	MATLAB Code
	initialize_broyden_linear	MATLAB Code
	maincontrol_broyden_loop	MATLAB Code
	process_data	MATLAB Code

disk_cal.mac

Enter the path of the location of all the files required to run this code in the RESUME command (currently set to `C:\Users\siddhesh_sakhalkar\Desktop\Siddhesh Codes\Static touchdown`).

```
RESUME, 'local_disk_silicon', 'db', 'C:\Users\siddhesh_sakhalkar\
\Desktop\Siddhesh Codes\Static touchdown', 0, 0 ! change path
```

slider_cal_protrusion.mac

Enter the path of the location of all the files required to run this code in the RESUME command (currently set to `C:\Users\siddhesh_sakhalkar\Desktop\Siddhesh Codes\Static touchdown`).

Enter the initial spacing between the head and the silicon wafer (currently set to 21.3 nm).

```
|finish
!
/clear
RESUME, 'WD_noTDS', 'db', 'C:\Users\siddhesh_sakhalkar\Desktop
\Siddhesh Codes\Static touchdown', 0, 0 ! change path

/prep7
TFCvolume=0.1*22*4.5
HGrate_permW=1e-3*1e12/TFCvolume
ini_clearance = 21.3
```

maincontrol_broyden_loop.m

Set the desired TFC Power range

%% Input Parameters

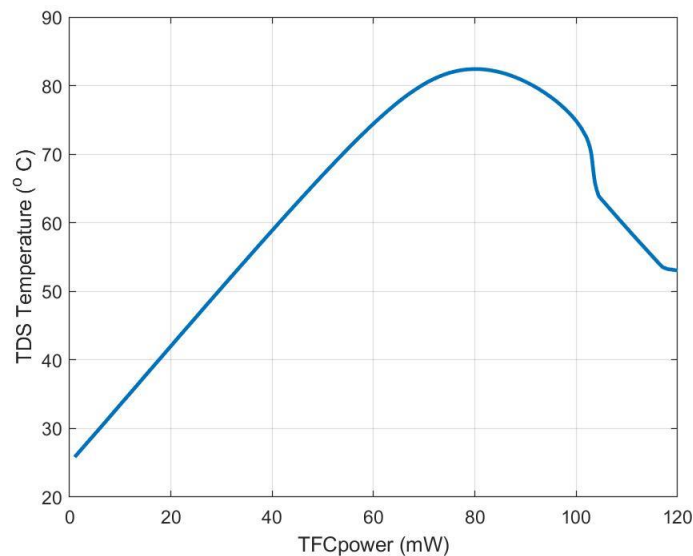
```
TFCPower = [1:102,102.1:0.1:106,107:120];
```

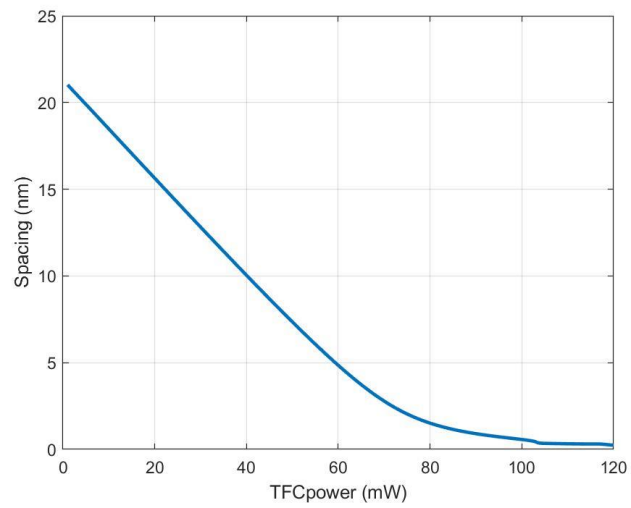
Enter the path of your ansys executable (currently set to `C:\Program Files\ANSYS Inc\v140\ansys\bin\winx64\ansys140.exe`) and the path of the location of all the files required to run this code (currently set to `C:\Users\siddhesh_sakhalkar\Desktop\Siddhesh Codes\Static touchdown`) in the system command on line **28** of the maincontrol.m file.

Run the maincontrol_broyden_loop.m file using MATLAB.

3. Example Simulation

The maincontrol_broyden_loop.m file will output the following figures for the example baseline simulation (static touchdown simulation on Si wafer in air with initial spacing of 21.3 nm). We plot the TDS temperature and the spacing vs the TFC Power in the range 0 to 120 mW.





4. References

- [1] S. V. Sakhalkar, Q. Cheng, A. Ghafari, Y. Ma and D. B. Bogy , "Numerical and experimental investigation of heat transfer across a nanoscale gap between a magnetic recording head and various media," *Applied Physics Letters*, **115**, 223102 (2019). <https://doi.org/10.1063/1.5119721>