

## ДОДАТОК А

### Код програми для 3D-принтера

В додатку викладені фрагменти згенерованого коду програми для 3D-принтера. Фрагмент коду початкової конфігурації принтера, який містить головні налаштування параметрів друку, а саме розмір деталі, час друку, діаметр філаменту:

```
; HEADER_BLOCK_START
; BambuStudio 01.08.04.51
; model printing time: 4h 43m 41s; total estimated time: 4h 49m 26s
; total layer number: 107
; model label id: 78
; filament_density: 1.26
; filament_diameter: 1.75
; max_z_height: 29.88
; HEADER_BLOCK_END

; CONFIG_BLOCK_START
; accel_to_decel_enable = 0
; accel_to_decel_factor = 50%
; activate_air_filtration = 0
; additional_cooling_fan_speed = 70
; auxiliary_fan = 1
; bed_custom_model =
; bed_custom_texture =
; bed_exclude_area = 0x0,18x0,18x28,0x28
; before_layer_change_gcode =
; best_object_pos = 0.5,0.5
; bottom_shell_layers = 3
; bottom_shell_thickness = 0
; bottom_surface_pattern = monotonic
; bridge_angle = 0
; bridge_flow = 1
; bridge_no_support = 0
; bridge_speed = 50
; brim_object_gap = 0.1
; brim_type = auto_brim
; brim_width = 5
```

Фрагмент коду очистки сопла та калібрування принтера:

```
;===== wipe nozzle =====
M1002 gcode_claim_action : 14
M975 S1
M106 S255
G1 X65 Y230 F18000
G1 Y264 F6000
M109 S200
G1 X100 F18000 ; first wipe mouth

G0 X135 Y253 F20000 ; move to exposed steel surface edge
G28 Z P0 T300; home z with low precision,permit 300deg temperature
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```

G29.2 S0 ; turn off ABL
G0 Z5 F20000

G1 X60 Y265
G92 E0
G1 E-0.5 F300 ; retrack more
G1 X100 F5000; second wipe mouth
G1 X70 F15000
G1 X100 F5000
G1 X70 F15000
G1 X100 F5000
G1 X70 F15000
G1 X100 F5000
G1 X70 F15000
G1 X90 F5000
G0 X128 Y261 Z-1.5 F20000 ; move to exposed steel surface and stop the nozzle
M104 S140 ; set temp down to heatbed acceptable
M106 S255 ; turn on fan (G28 has turn off fan)

M221 S; push soft endstop status
M221 Z0 ;turn off Z axis endstop
G0 Z0.5 F20000
G0 X125 Y259.5 Z-1.01
G0 X131 F211
G0 X124
G0 Z0.5 F20000
G0 X125 Y262.5
G0 Z-1.01
G0 X131 F211
G0 X124
G0 Z0.5 F20000
G0 X125 Y260.0
G0 Z-1.01
G0 X131 F211
G0 X124
G0 Z0.5 F20000
G0 X125 Y262.0
G0 Z-1.01
G0 X131 F211
G0 X124
G0 Z0.5 F20000
G0 X125 Y260.5
G0 Z-1.01
G0 X131 F211
G0 X124
G0 Z0.5 F20000
G0 X125 Y261.5
G0 Z-1.01
G0 X131 F211
G0 X124
G0 Z0.5 F20000
G0 X125 Y261.0
G0 Z-1.01
G0 X131 F211
G0 X124
G0 X128
G2 I0.5 J0 F300
G2 I0.5 J0 F300
G2 I0.5 J0 F300
G2 I0.5 J0 F300

M109 S140 ; wait nozzle temp down to heatbed acceptable
G2 I0.5 J0 F3000
G2 I0.5 J0 F3000

```

```

G2 I0.5 J0 F3000
G2 I0.5 J0 F3000

M221 R; pop softend status
G1 Z10 F1200
M400
G1 Z10
G1 F30000
G1 X230 Y15
G29.2 S1 ; turn on ABL
;G28 ; home again after hard wipe mouth
M106 S0 ; turn off fan , too noisy
;===== wipe nozzle end =====

;===== bed leveling =====
M1002 judge_flag g29_before_print_flag
M622 J1

    M1002 gcode_claim_action : 1
    G29 A X2.64313 Y40.5009 I250.714 J174.998
    M400
    M500 ; save cali data

M623
;===== bed leveling end =====

```

Фрагмент коду який відповідає за переміщення головки принтера та екструзію філаменту:

```

; start printing object, unique label id: 78
M624 AAAAAAAAAA=
G1 X145.214 Y206.956 F30000
G1 Z.4
G1 Z.2
G1 E.8 F1800
; FEATURE: Inner wall
; LINE_WIDTH: 0.5
G1 F3000
G1 X145.214 Y199.356 E.28307
G1 X198.289 Y199.356 E1.97685
G1 X218.289 Y129.356 E2.71156
G1 X251.002 Y129.356 E1.21843
G1 X252.5 Y130.854 E.0789
G1 X252.5 Y141.144 E.38326
G1 X251.002 Y142.642 E.0789
G1 X227.71 Y142.642 E.86752
G1 X207.71 Y212.642 E2.71156
G1 X49.003 Y212.642 E5.91123
G1 X29.003 Y142.642 E2.71156
M73 P1 R283
G1 X5.712 Y142.642 E.86752
G1 X4.214 Y141.144 E.0789
G1 X4.214 Y130.854 E.38326
G1 X5.712 Y129.356 E.0789
G1 X38.425 Y129.356 E1.21843
G1 X58.425 Y199.356 E2.71156
G1 X111.5 Y199.356 E1.97685
G1 X111.5 Y206.956 E.28307
G1 X145.154 Y206.956 E1.25349

```

G1 X144.757 Y206.499 F30000  
; FEATURE: Outer wall  
G1 F3000  
G1 X144.757 Y198.899 E.28307  
G1 X197.944 Y198.899 E1.98103  
G1 X217.944 Y128.899 E2.71156  
G1 X251.191 Y128.899 E1.23832  
G1 X252.957 Y130.665 E.09301  
G1 X252.957 Y141.333 E.39737  
G1 X251.191 Y143.099 E.09301  
G1 X228.055 Y143.099 E.86173  
G1 X208.055 Y213.099 E2.71156  
G1 X48.659 Y213.099 E5.93692  
G1 X28.659 Y143.099 E2.71156  
G1 X5.523 Y143.099 E.86173  
G1 X3.757 Y141.333 E.09301  
G1 X3.757 Y130.665 E.39737  
G1 X5.523 Y128.899 E.09301  
G1 X38.769 Y128.899 E1.23832  
G1 X38.823 Y129.087 E.00727  
G1 X58.769 Y198.899 E2.70429  
G1 X111.957 Y198.899 E1.98103  
G1 X111.957 Y206.499 E.28307  
G1 X144.697 Y206.499 E1.21944  
; WIPE\_START  
G1 F24000  
G1 X144.713 Y204.499 E-.76  
; WIPE\_END  
G1 E-.04 F1800  
G1 X151.021 Y200.203 Z.6 F30000  
G1 X252.317 Y131.221 Z.6  
G1 Z.2  
G1 E.8 F1800  
; FEATURE: Bottom surface  
; LINE\_WIDTH: 0.500574  
G1 F6300  
G1 X250.84 Y129.745 E.07787  
G1 X250.193 Y129.745 E.02414  
M73 P2 R283  
G1 X252.111 Y131.663 E.10116  
G1 X252.111 Y132.31 E.02414  
G1 X249.546 Y129.745 E.13529  
G1 X248.899 Y129.745 E.02414  
G1 X252.111 Y132.957 E.16943  
G1 X252.111 Y133.604 E.02414  
G1 X248.252 Y129.745 E.20356  
G1 X247.604 Y129.745 E.02414  
G1 X252.111 Y134.252 E.2377  
G1 X252.111 Y134.899 E.02414  
G1 X246.957 Y129.745 E.27183  
G1 X246.31 Y129.745 E.02414  
G1 X252.111 Y135.546 E.30597  
G1 X252.111 Y136.193 E.02414  
G1 X245.663 Y129.745 E.3401  
G1 X245.015 Y129.745 E.02414  
G1 X252.111 Y136.84 E.37424  
G1 X252.111 Y137.488 E.02414  
G1 X244.368 Y129.745 E.40837  
G1 X243.721 Y129.745 E.02414  
G1 X252.111 Y138.135 E.4425  
G1 X252.111 Y138.782 E.02414  
G1 X243.074 Y129.745 E.47664  
G1 X242.427 Y129.745 E.02414  
G1 X252.111 Y139.429 E.51077

G1 X252.111 Y140.077 E.02414  
G1 X241.779 Y129.745 E.54491  
G1 X241.132 Y129.745 E.02414  
G1 X252.111 Y140.724 E.57904  
G1 X252.111 Y140.983 E.00967  
G1 X251.917 Y141.177 E.01023  
G1 X240.485 Y129.745 E.60295  
G1 X239.838 Y129.745 E.02414  
G1 X251.594 Y141.501 E.62002  
G1 X251.27 Y141.824 E.01707  
G1 X239.19 Y129.745 E.63708  
G1 X238.543 Y129.745 E.02414  
G1 X250.947 Y142.148 E.65415  
G1 X250.841 Y142.253 E.00557  
G1 X250.405 Y142.253 E.01626  
G1 X237.896 Y129.745 E.65972  
G1 X237.249 Y129.745 E.02414  
G1 X249.758 Y142.253 E.65972  
G1 X249.11 Y142.253 E.02414  
G1 X236.602 Y129.745 E.65972  
G1 X235.954 Y129.745 E.02414  
G1 X248.463 Y142.253 E.65972  
G1 X247.816 Y142.253 E.02414  
G1 X235.307 Y129.745 E.65972  
G1 X234.66 Y129.745 E.02414  
G1 X247.169 Y142.253 E.65972  
G1 X246.522 Y142.253 E.02414  
G1 X234.013 Y129.745 E.65972  
G1 X233.366 Y129.745 E.02414  
G1 X245.874 Y142.253 E.65972  
G1 X245.227 Y142.253 E.02414  
G1 X232.718 Y129.745 E.65972  
G1 X232.071 Y129.745 E.02414  
G1 X244.58 Y142.253 E.65972  
G1 X243.933 Y142.253 E.02414  
G1 X231.424 Y129.745 E.65972  
G1 X230.777 Y129.745 E.02414  
G1 X243.285 Y142.253 E.65972  
G1 X242.638 Y142.253 E.02414  
G1 X230.129 Y129.745 E.65972  
G1 X229.482 Y129.745 E.02414  
G1 X241.991 Y142.253 E.65972  
G1 X241.344 Y142.253 E.02414  
G1 X228.835 Y129.745 E.65972

ДОДАТОК Б  
Демонстраційний матеріал

