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Memorandum

TO : See Addressees

DATE: September 19, 1966

FROM : Chief, Guidance and Control
Systems Analysis Branch, R-ASTR-NG

In reply refer to:
R-ASTR-NG-137-66

SUBJECT: Steady-state responses for accelerometer control
and SMC control

1. Reference is made to NASA TM X-53504, dated 16 August 1966, subject: "Steady-state Responses for Several Control Systems."
2. The enclosed table lists steady-state responses for several choices of gains in addition to those shown in Table III of the referenced report.

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1 Enc:
a/s

cc:

R-ASTR-N, Mr. Moore
R-ASTR-N, Mr. Gassaway
R-ASTR-NG, Mr. Brooks
R-ASTR-NGD, Mr. Chubb
R-ASTR-NGD, Mr. Jones/Mr. Applegate
R-ASTR-NGD, Mr. Brown
R-ASTR-NG, Branch file/record copy
R-ASTR-X, Reference file

ALPS

Assume $W(t)$ and $x_z(t)$ are step functions

Variable	Forcing Function	Accelerometer Control				SMC, $K = 0.5$	
		General, $g_2 = 1$		Drift Minimum			
		$a_0 = .4,$ $a_1 = .5$	$a_0 = 1,$ $a_1 = 1.5$	$a_0 = .4,$ $a_1 = .5$	$a_0 = 1,$ $a_1 = 1.5$	$a_0 = .4,$ $a_1 = .5$	$a_0 = 1,$ $a_1 = 1.5$
$x_c(t)_{ss}$	β_ϵ	$87.818\beta_\epsilon$	$29.009\beta_\epsilon$	∞	∞	$0.4788\beta_\epsilon$	$0.6669\beta_\epsilon$
	d	220.157d	88.497d	∞	∞	4.5939d	1.4355d
	$W(t)$	W	W	0.01712W	0.0257W	0.0440W	0.03276W
	$x_z(t)$	0	0	$0.5244x_z$	$0.6835x_z$	0	0
	θ_ϵ	$35.0845\theta_\epsilon$	$28.996\theta_\epsilon$	∞	∞	$0.6614\theta_\epsilon$	$0.6669\theta_\epsilon$
$x_\epsilon(t)_{ss}$	β_ϵ	0	0	$2.4573\beta_\epsilon$	$1.3215\beta_\epsilon$	0	0
	d	0	0	6.8318d	4.0325d	0	0
	$W(t)$	0	0	0	0	0	0
	$x_z(t)$	0	0	0	0	0	0
	θ_ϵ	0	0	$0.3037\theta_\epsilon$	$1.3215\theta_\epsilon$	0	0
$\alpha(t)_{ss}$	β_ϵ	$11.40837\beta_\epsilon$	$3.372\beta_\epsilon$	∞	∞	$0.1471\beta_\epsilon$	$0.05935\beta_\epsilon$
	d	27.0506d	11.049d	∞	∞	1.9738d	0.6749d
	$W(t)$	0	0	-0.08835W	-0.1188W	-0.0854W	-0.08608W
	$x_z(t)$	0	0	$0.03805x_z$	$0.0654x_z$	0	0
	θ_ϵ	$3.5168\theta_\epsilon$	$2.605\theta_\epsilon$	∞	∞	$0.0592\theta_\epsilon$	$0.05935\theta_\epsilon$
$\beta(t)_{ss}$	β_ϵ	$0.85689\beta_\epsilon$	$0.713\beta_\epsilon$	∞	∞	$-0.9442\beta_\epsilon$	$-0.8416\beta_\epsilon$
	d	2.0346d	1.945d	∞	∞	-2.0135d	-2.0311d
	$W(t)$	0	0	-0.007846W	-0.0105W	-0.00758W	-0.007648W
	$x_z(t)$	0	0	$0.003381x_z$	$0.00545x_z$	0	0
	θ_ϵ	$0.03125\theta_\epsilon$	$0.2314\theta_\epsilon$	∞	∞	$0.00542\theta_\epsilon$	$0.00528\theta_\epsilon$

Enclosure 1¹

Assume $W(t)$ and $x_z(t)$ are step functions

Variable	Forcing Function	Accelerometer Control				SMC, $K = 0.5$	
		General, $g_2 = 1$		Drift Minimum		$a_0 = .4,$ $a_1 = .4$	$a_0 = 1,$ $a_1 = 1.5$
		$a_0 = .4,$ $a_1 = .5$	$a_0 = 1,$ $a_1 = 1.5$	$a_0 = .4,$ $a_1 = .5$	$a_0 = 1,$ $a_1 = 1.5$		
$\alpha]q_{ss}$	β_ϵ	$-2.1447\beta_\epsilon$	$-0.8725\beta_\epsilon$	$-1.9242\beta_\epsilon$	$-0.6896\beta_\epsilon$	$-1.0368\beta_\epsilon$	$-1.0975\beta_\epsilon$
	d	$-3.4748d$	$-1.414d$	$-2.1729d$	$0.9477d$	$-2.3756d$	$-2.5147d$
	$W(t) - \dot{x}_c(t)$	$-0.1118(W - \dot{x}_c)$	$-0.1137(W - \dot{x}_c)$	$-0.1002(W - \dot{x}_c)$	$-0.0897(W - \dot{x}_c)$	$+0.7837\dot{x}_c$	$+2.032\dot{x}_c$
	$x_z(t)$	0	0	0	0	0	0
	θ_ϵ	$-0.8579\theta_\epsilon$	$-0.8725\theta_\epsilon$	$-0.7697\theta_\epsilon$	$-0.6896\theta_\epsilon$	$-0.4148\theta_\epsilon$	$-1.0975\theta_\epsilon$
$\beta]q_{ss}$	β_ϵ	$-1.19053\beta_\epsilon$	$-1.0078\beta_\epsilon$	$-1.2890\beta_\epsilon$	$-1.0612\beta_\epsilon$	$-0.4148\beta_\epsilon$	$-1.0975\beta_\epsilon$
	d	$-2.60003d$	$-2.2571d$	$-2.7501d$	$-2.5530d$	$-0.9503d$	$-2.5147d$
	$W(t) - \dot{x}_c(t)$	$-0.00992(W - \dot{x}_c)$	$-0.0101(W - \dot{x}_c)$	$-0.00890(W - \dot{x}_c)$	$-0.00275(W - \dot{x}_c)$	$+0.05824\dot{x}_c$	$+0.1541\dot{x}_c$
	$x_z(t)$	0	0	0	0	0	0
	θ_ϵ	$0.07621\theta_\epsilon$	$0.0775\theta_\epsilon$	$-0.06836\theta_\epsilon$	$-0.0613\theta_\epsilon$	$-0.0368\theta_\epsilon$	$-0.0975\theta_\epsilon$